THE NEW AGE GEOGRAPHIES

SENIOR SERIES. BOOK V.

THE REGIONS OF THE WORLD

L. DUDLEY

BY

L. DUDLEY STAMP, B.A., D.Sc., F.R.G.S.

Sir Ernest Cassel Reader in Economic Geography, University of London

WITH TWO COLOURED PLATES AND OTHER ILLUSTRATIONS

LONGMANS, GREEN AND CO.

LONDON • NEW YORK • TORONTO

1933

LONGMANS, GREEN AND CO. LTD
39 PATERNOSTER ROW, LONDON, E C.4
6 OLD COURT HOUSE STREET, CALCUTTA
53 NICOL ROAD, BOMBAY
36A MOUNT ROAD, MADRAS

LONGMANS, GREEN AND CO.
55 FIFTH AVENUE, NEW YORK
221 EAST 20TH STREET, CHICAGO
88 TREMONT STREET, BOSTON
128-132 UNIVERSITY AVENUE, TORONTO

THE NEW AGE GEOGRAPHIES
JUNIOR SERIES

By L. DUDLEY STAMP, B.A., D.Sc., and
ELSA C. STAMP, B.A. (Hons.)

Book I. AT HOME (Rural Edition for Country Schools) 1s 6d
Book I. AT HOME (Urban Edition for Town Schools) 1s 6d
Book II. FAR AWAY 1s 8d
Book IIIa. ROUND THE WORLD 2s
Book IIIb. MORE TRAVELS ROUND THE WORLD 2s
Book IV. ROUND THE BRITISH ISLES. 2s

Each Volume with 4 Coloured Plates and many Illustrations and Maps

THE NEW AGE GEOGRAPHIES
SENIOR SERIES

By L. DUDLEY STAMP, B.A., D.Sc.

Book V. THE REGIONS OF THE WORLD
Book VI. THE COUNTRIES OF THE WORLD: EUROPE
Book VII. THE REST OF THE WORLD.

With 2 Coloured Plates and other Illustrations and Maps in each Part Crown 8vo 2s each

A SMALLER WORLD GEOGRAPHY

By L. DUDLEY STAMP, B.A., D.Sc.

With Illustrations and Maps Crown 8vo 4s
Contains Books V–VII complete in one volume without Coloured Plates

Printed in England by William Clowes and Sons, Ltd., Beccles

PREFACE

This book is the first of the three parts of my Smaller World Geography and is intended for the first of a three years' course in a Senior School or in the lower forms of a Secondary School. As explained in the Preface to the whole book, I have said to myself in writing these books, what ought a boy or girl in any walk of life to know in order to realise that our modern civilisation in this country depends upon the proper utilisation of the resources of the whole world and on the progress and prosperity of each of its countries? This book lays the foundation by considering the basis of geography, the great regions of the world and their relationship to the life of man. In the two other books a modicum of information is conveyed on each of the countries of the world to make intelligible the news conveyed to us in the daily press

As one of our leading business men said recently, in giving advice on education for business, geography is perhaps the most human of all studies May we thus use it in the training of the citizens of the future

L D. S.

University of London.
December, 1932.

CONTENTS

25931

SECTION I

WHY SHOULD WE LEARN GEOGRAPHY?

How did you get to school this morning? Probably you walked, if it is not too far, but some of you may have come by motor bus or by other means if it is a long way from your home to school. At what time did you start? Did you allow five minutes to get here, or did you allow twenty minutes? The answer to that question of course depends again on how far it is from your home to the school. The things we do every day must depend very largely on where we live, and indeed on the exact position of our homes and of the places to which we have to go. It is just the same with the life of whole villages and towns, and even of countries. What they do—their activities—depends very largely on where they are situated. The great ports which surround this country could not have developed if they had been situated inland away from the sea, or from the great river mouths. Similarly with countries. Many of their activities depend upon where they are situated. In the early months of the year we can buy in our shops bunches of flowers which have been grown and cut in the south of France, where the winters are warmer than in England. Those flowers can be cut and sent to us because it does not take more than twenty-four hours for them to get to us in England. But although it would be possible for far-away New Zealand, 12,000 miles away from us, to grow such flowers, the position of New Zealand in relation to the position of the British Isles makes it impossible for New Zealand to send us flowers. So one of the things we always have to consider in geography is the importance of **position.**

Could you describe the town or village in which you

live? Just think for a moment about it, and then say whether all the streets are level and flat or whether some of them go uphill and downhill Then think, too, about the roads that you know how they have to curve, perhaps to avoid a hill, or perhaps to avoid a wet place, or perhaps to go to some point where a bridge has been built across a river The more you think about these things the more you will see that our everyday life is affected by the surface of the ground, whether the surface of the ground is flat or hilly and whether there are streams and rivers running across the surface, or here and there large ponds or marshes No doubt your own home town or village has been built in the particular place where it is for some special reason It may be at a meeting place of roads where there are easy ways to the surrounding towns, or it may have been built originally where the people could easily get water, for in the days of long ago there were no water companies who kindly laid down pipes and brought the water to the peoples' houses. If you have not yourself been to mountainous countries you have at least seen pictures of those countries On those mountains with their steep slopes, sometimes, it may be, covered with snow, there are very few houses, perhaps no houses at all The towns and villages are all on the lower ground where men can cultivate the fields Even in our own islands there are eight times as many people in the comparatively small Midland Valley of Scotland as there are in the whole of the Scottish Highlands. You will see from these examples that the surface of the ground, or, as we say, the **physical features** of a country, have a great deal to do with the life of man

But what happens under the ground? Sometimes we can see a brick pit or a quarry which shows that underneath the soil there is clay or chalk or some other substance. On this often depends what can be grown on the soil itself Then many of us live in mining towns or villages where there is coal underground, and it is really because of that coal that the town has grown up where we find it. So in

geography we learn just a little about what lies under the surface of the ground because, especially where there are important minerals found, the **structure of the earth**, or its geology, has an important influence on the lives of men.

Now let us think about the clothes you are wearing. When you got up this morning did you glance out of the window to see what sort of weather it was to-day? Perhaps it was raining and you thought to yourself "I shall have to wear my mackintosh to school to-day". Lots of the little things which we have to think about every day depend upon the weather. You all wear warmer clothes in the winter than you do in the summer, for example. Then just think how miserable it would be in the winter time if we did not have at home a nice fire to warm us; yet there are countries where it is so warm all the year round that the people build their houses without any fireplaces at all, and so you see that the builders in this country have to think about the weather. They think about the weather, too, when they are building the roof. They have to make the roof slope so that when the rain falls the water will run off and will not soak into the rooms and make them wet; but in many parts of the world it is so dry that the houses can be built with flat roofs. Indeed, the rainfall is sometimes so precious that a man carefully collects all that falls on the roof of his house. So we see there are many reasons why in geography we must watch the **weather**. We shall learn later that the average or normal condition of the weather forms **climate**.

But there are other less direct ways in which the weather affects the lives of men. Just think of most of the trees in this country and the way in which they lose their leaves in the autumn. They are bare and apparently dead in the winter, and then in the spring-time they get their new green covering again. This is because the trees in this country take a long rest during the winter; but there are many parts of the world where the trees are green all the year round and do not have a winter rest, because it is so hot and moist that there really is no winter at all.

Then again many of you at home have a garden, or perhaps your father has an allotment. Just think for a minute and make a list of the things which you can grow. There are cabbages and cauliflowers, peas and beans, potatoes and beetroots, and many other vegetables Perhaps you have some fruit trees, apples or pears or cherries or plums All these things we can grow in our country because the weather or climate is suitable for them. But how many of you have seen an orange tree with oranges growing, or a banana palm with its bunches of bananas? You have not seen them growing in this country because again the weather or climate is not suitable It is not warm enough for these plants So we see that it is necessary in geography to learn something about the plants of a country, or the **vegetation**, because the plant life has a very important effect on the activities of man.

In the same way there are the **animals.** We could not keep cows to give us milk if there were not green grass or other food for them to feed upon. Even the very small animal life is often very important to man We are lucky in this country. Sometimes we get bitten by midges or mosquitoes in the summer, but we do not have mosquitoes that carry with them terrible diseases, in some countries of the world the life of man is made almost impossible by the immense number of dangerous insects.

We have now learnt of the different geographical factors which help to make up the background of our lives, or, to use a longer word, to form the **physical environment** in which man lives All these different factors work together to determine our daily life We are influenced in some way by each of them, and so we can show by a little diagram, such as the one given below, the way in which factors work together to influence our lives.

But man is a thinking animal, and when he has taken thought he is often able to change some of these factors of his environment. Let us look for a minute at some of the ways in which we can do this We cannot alter the fact of position: we cannot alter the fact, for example,

that London is in England on one side of the Atlantic Ocean, and that New York is in the United States on the other side of the Atlantic, 1,000 miles away But we can do many things to overcome the disadvantages of position. We have telegraphs and telephones so that a man in London may speak to a friend in New York We have swift steamships which cover the distance much more rapidly than did the old sailing ships in days gone by. On land we have fast trains and fast motor buses I lived for some years of my life where there are no real roads and where the only means of travelling from one place to another was by a cart drawn by two slow bullocks These carts were

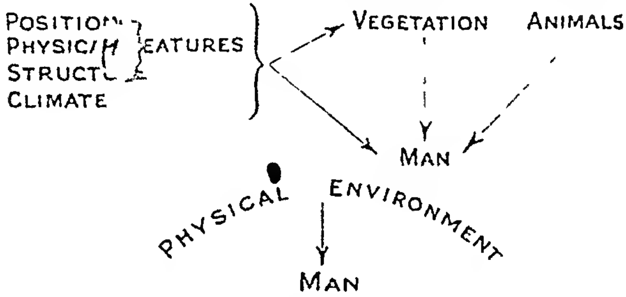


FIG 1 —The geographical factors

not able to travel more than two miles an hour, and did not go more than fifteen miles in a day, so if I wanted to go on a journey of sixty miles it took me four days, yet in this country we should be able to take an express train and go the whole distance in only one hour. Man therefore cannot change position, but he can do a great deal to overcome some of the disadvantages of position. Man cannot do very much to alter the physical features of a country. If a country is very mountainous he cannot make it into a plain, but if there is a great stretch of flat marshy land which is not of very much use, man can carefully drain it and turn it into valuable farm land In the heart of the little country of Holland there is a broad

shallow arm of the sea called the Zuider Zee. The Dutch have decided to turn this shallow sea into dry land by building banks round it and then pumping out the water. Sometimes therefore, man can do quite a lot to alter the physical features of a country He can construct railway tunnels and so make travel which would otherwise be very difficult much more simple When it comes to altering the structure of the earth, then very little indeed can be done We cannot place a coalfield where a coalfield has not already been placed by nature We can do a little, perhaps, in the way of improving a poor soil by adding manure to it, but this really only affects the surface of the earth and not the underlying structure. Then, too, what can we do to alter the effect of weather or climate? (Climate is simply the average or normal state of the weather) Well, we can protect ourselves against it, but we cannot stop it from raining, and we cannot bring the rain sometimes when we want it We can make our houses warm to counteract the cold, and we can sometimes grow plants in greenhouses and keep them warm there, but if it is too hot we still know very little about how to make it cooler It is true we have learnt how to keep meat fresh by freezing it or cooling it, and by this means we can bring fresh meat from distant parts of the earth. Similarly too we can bring such things as fresh fruit We cannot, then, do very much to alter the weather or climate, but we can do quite a lot to counteract its effects When it comes to man's influence on vegetation, quite a lot can be done He can cut down the forests or the grass which grows naturally, and can plant other trees or plants in the place of those which were growing wild. In a country like England there is now very very little left of the natural vegetation of the country, the whole surface has been altered by the work of man So it is too, with the animal life We can kill off many of the wild animals, and we can bring from one country to another different domestic animals The English sheep of different breeds are now found throughout Australia and New Zealand and many

other parts of the world, many thousands of miles away from this country. Man has learnt a great deal about how to combat the smaller animal life—how to get rid of some of the insect plagues and how to prevent the spread of disease Sixty years ago when the French tried to construct the Panama Canal thousands of workers were killed by a terrible illness called yellow fever. Now yellow fever has been conquered by man, and it is almost non-existent in the Panama Canal Zone Let us now redraw our little

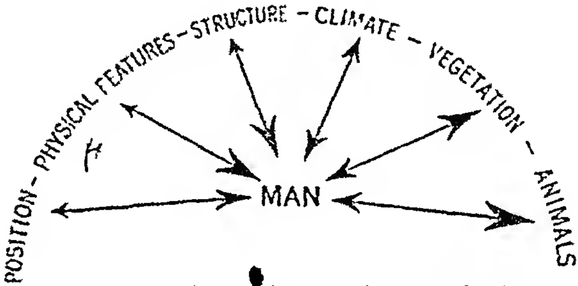


FIG. 2.—The influence of man on the geographical factors

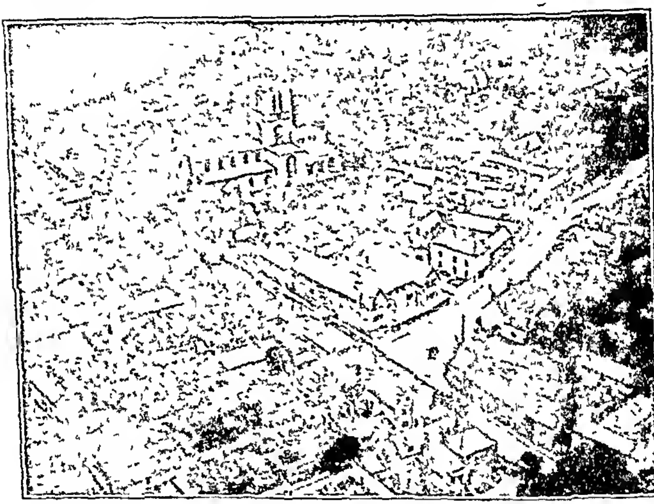
diagram and show by the arrows with barbs at each end, how man is not only affected by these different factors of his environment, but also how he is able to exert his influence on them. In the chapters which follow we are going to learn a little more about each of these different factors by which we are surrounded, and see something of the way in which they affect our everyday lives.

SECTION II

FINDING OUT WHERE WE LIVE

PERHAPS you will say at once, "Of course we know where we live. What is there to find out ?" But suppose you have a friend in Canada or Australia who wants to send

you a letter He has to put first of all your name and then the name or number of your house the street and the town, then perhaps the county, and at the bottom of the envelope England or Great Britain You will see that he has tried to express exactly where you live so that the postmen and the post offices understand it and will be able to send the letter so that it reaches you But there are other ways in which we can express position The most



[Photo Aerofilms, Ltd

FIG 3—View taken from an aeroplane looking forward. It shows a village at the junction of two roads

important of all these ways is by means of a map. We often talk about getting a bird's-eye view of something, and that is really what a map is, it is a bird's-eye view of the country, for we think of a bird flying high up in the sky and looking downwards upon the earth But it is not really necessary to imagine what a bird can see, because we can ourselves go up in an aeroplane and look down upon the earth. If, when we are up in the aeroplane, we

look not directly underneath us but slightly forward, we shall get a view of the country such as is shown in Fig 3 Such a picture certainly gives us a very clear idea of the country, and we shall in many places in this book use similar pictures that have been taken from aeroplanes We see the buildings very clearly because we can see both the walls of the buildings and the roofs at the same time But if we look directly underneath us we shall only be able to see the roofs of the houses, for the walls will be hidden. If we take a photograph from the air with the camera pointing directly downwards, we shall get such a photograph as is shown in Fig 4 Now look carefully at that photograph. You will see that there are numerous dark blobs. They are the leafy tops of large trees and, unfortunately, they often hide what is underneath them. Suppose you have a line of trees along the side of a roadway: the tops of the trees may be so large that they will hide the road altogether: but really the road is more important than the trees If we could imagine the trees cut down, the road would then be clearly visible, and here we have what is really the chief difference between a map and an aeroplane photograph. The photograph shows everything as it is seen from above but when we make a map we can cut out the things that we think are not important, such as the tops of the trees, and we can leave only those things, such as the roads and buildings, which we consider are important Now look carefully at Fig. 5 and compare it with the last, and you will see the difference between the map and the photograph of the same piece of country. You will notice that the map shows the roads, the buildings, and the divisions between the fields, but it is a map of only a very small piece of country.

If we could imagine our aeroplane going higher and higher, we should soon reach a level from which it would be impossible to see the individual fields or the individual houses. A mass of houses together making a village or a town would appear as a blur. We might still be able to see the lines running between the villages representing

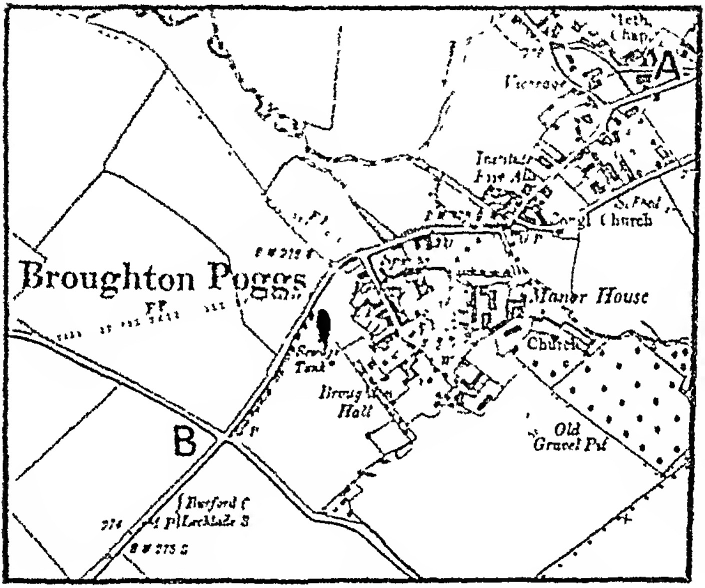
the railway lines or the roads, and we could make another map this time showing railways, roads, villages, and towns, but not the separate houses or the fields. Most aeroplanes do not travel at a greater height than 10,000 or 12,000 feet but suppose you imagine that an aeroplane could go very much higher still and yet it was possible to see the

[Photo Aerofilms, Ltd

FIG 4 —A view taken from an aeroplane looking directly downwards, showing a village in the country.

surface of the earth We might look downwards and see just the bare outline of our country, the British Isles, standing out in the middle of the sea, and giving us a shape such as is shown in Fig 6 From such a height we should not be able to see roads or villages, perhaps not even be able to distinguish the largest towns, but we should still be able to say to ourselves " that is the outline

of the British Isles," and we know that in the British Isles there are a number of important towns and we could say, "Although we cannot see them clearly let us mark them by dots and give them their names." And so we should make a map of the British Isles. So when you study your atlas or the maps that are in this book, try and think of them as having been made in this way. Try and picture



[Based upon Ordnance Survey Map, with the sanction of the Controller of H M Stationery Office.

FIG 5.—A map of the same area as the last figure.

yourself high up in the air looking down on the country, and then just putting on the outline which you can see what you know to be the important things

Maps which only show a small piece of country are called large scale maps. Fig 5 is an example of a large scale map, and we can now find out what we mean by the scale of a map. Look again at Fig. 4. If we live in that part

th . . . . try we know by measuring on the ground that . . . . ance from point A the spire of the church, to the . B, the crossroads is exactly half a mile in a straight . When we look at Fig. 5, which is the map of the . e area we find that on the map the distance between ose same two points is exactly three inches, and so we n say that three inches on the map represents half a

Fig 6

mile on the ground, or that six inches on the map represents one mile on the ground; and so we say that the scale of the map is six inches to one mile. In the British Isles there is a Government Department called the Ordnance Survey which has its head offices at Southampton The Ordnance Survey issues many different maps of the British Isles There is a series covering th

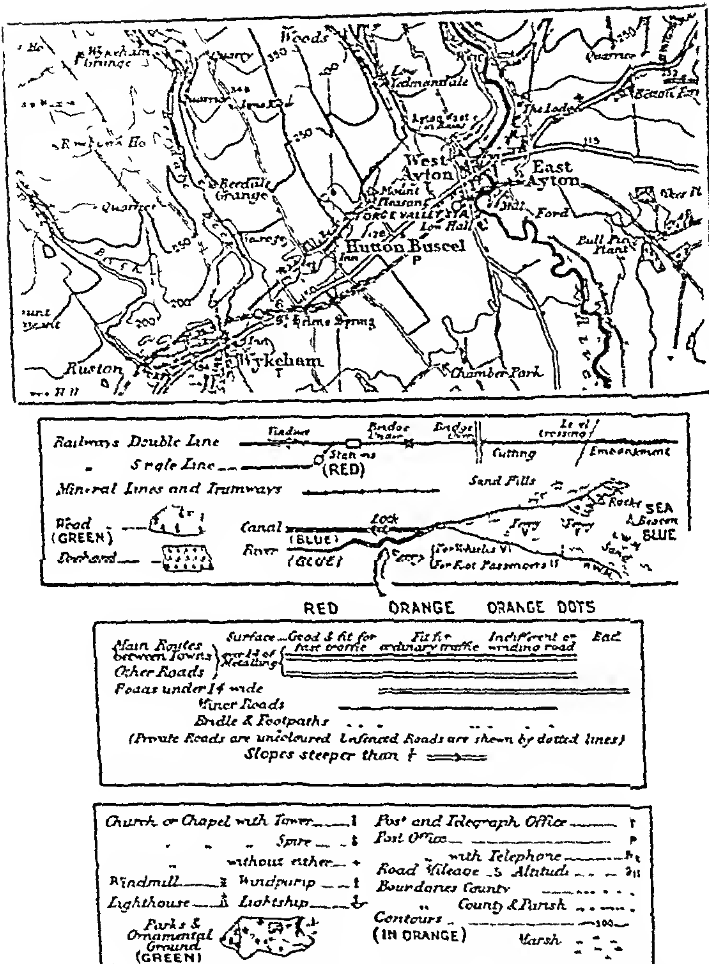
whole of the islands on the scale of six inches to the mile, and Fig. 5 is an example of one of these maps Another very important series issued by the Ordnance Survey is the series on the scale of one inch to one mile. You have an example of one of these maps in Fig 7. If we are looking down at a piece of country from an aeroplane it is not always easy to distinguish which is a road and which is a railway, and perhaps even which is a canal or which is a road, and so when we are drawing a map we have to make a difference between these things In order to make the difference stand out clearly we employ what are called "conventional signs," and so underneath Fig 7 you have a number of conventional signs which are used on those maps of the scale of one inch to the mile. Study these signs carefully and then try and find on the piece of map a church, a footpath, a canal. and various other things

But in our atlases and books we often want to show certain things about a whole country on one small map, and so we have what are called small scale maps, and on these one inch may represent even hundreds of miles. Look at the small outline of the British Isles (Fig 6). It is 350 miles from London to Glasgow, two points which are marked on the map, and yet you see that the distance between those two points on the map is only $1\frac{3}{4}$ inches, and we can work out from this that the scale of this map is 200 miles to the inch.

But there is another way of expressing the scale of a map. Let us suppose that one inch on the map represents one mile on the ground. You can then work out this sum, remembering that there are twelve inches in a foot, three feet in a yard, and 1,760 yards in a mile

If one inch represents one mile—
then one inch represents 1,760 yards,
one inch represents $1{,}760 \times 3 = 5{,}280$ feet,
$\therefore$ one inch represents $1{,}760 \times 3 \times 12 = 63{,}360$ inches

We have now found out that one inch on the map represents 63,360 inches on the ground, and we say that



[Ordnance Survey, One inch Popular Edition by permission of the Controller of H M. Stationery Office]

FIG. 7.—Part of a map on the scale of one inch to one mile, and explanations of the signs used

$\frac{1}{63360}$ is the "Representative Fraction" of the map. Now work out what is the Representative Fraction, or R F., of a map on the scale of six inches to one mile, and a map on the scale of one inch to a hundred miles

We have now learnt one way of finding out where we live. It is by reading a map If we know that our home is ten miles from a big town we can find that big town marked on the map, and then by means of the scale of the map can work out exactly where our home is situated by following along in the right direction You will learn later how a map can teach us a great many other things about the character of a country and the different ways in which we can show hills and valleys on a map

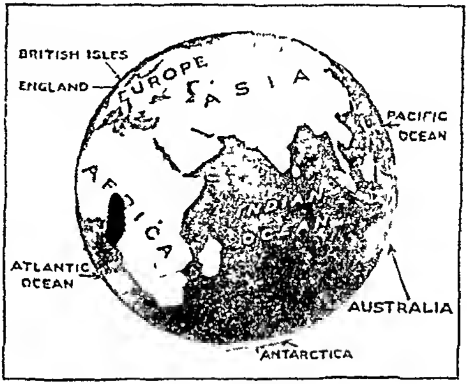


FIG 8 —The Old World

A little while ago we imagined ourselves going up so high in an aeroplane that we could see the whole of the outline of the British Isles at once. Of course it is not possible to do this But let us for a moment imagine that we could go up still higher in our aeroplane, so as to get right away from the earth We should see then that the earth is really a huge ball floating in space. We might be able to see just the outline of the great masses of land and the great oceans which separate them, and we might get a view which looks rather like Fig. 8 Sometimes we talk about the men in the moon, though there are no men in the moon, but if we could imagine ourselves on the surface of the moon, the earth would look to us rather as it does in this picture. I have put on it some

of the names of the great masses of land, or continents as they are called Of course we should only be able to see one side of the earth at once But if we could turn it round and see the other side we should get a picture rather like that shown in Fig 9 You will see from these two pictures that there are really seven great pieces of land, or continents the continents of North America and South America, which make up the New World, and the three continents which make up the Old World · Europe, Asia, Africa Then there is Australia and another big piece of land to the south, the continent of Antarctica Now notice the great masses of water or oceans which separate the land masses

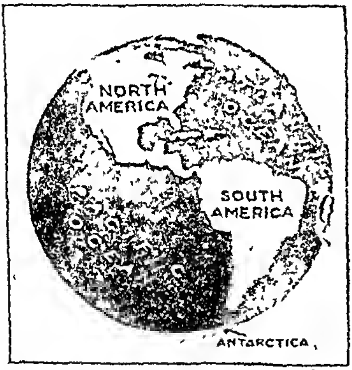


Fig 9 — The New World

No doubt you have at school a globe, which is really a small model of the earth as it actually is, but no doubt if you think about it you will say "the earth cannot really be like that because the oceans are very deep, and on the surface of the land there are very high mountains and hills." Here we must remember something about the size of the earth. It is nearly 8,000 miles from one side of the earth to the other, or, as we say, the diameter of the earth is roughly 8,000 miles. But the deepest part of the ocean is only a little over six miles deep, and the highest mountain on the earth is not quite six miles high, and you will find that if you put a tiny grain of sand on your school globe, that represents in its proper size the highest mountain of the earth. Now, how can we find the position of where we live on the surface of the school globe? Well, of course

we can look for our country and probably find its name and see roughly where our home is, but suppose you want to know the position of a ship which is crossing the Pacific Ocean. It might be thousands of miles from any land, and what would happen if that ship had an accident, its engine broke down, and it was unable to go on? With the help of modern invention it could send out a wireless message asking for help. But what would be the use of saying, "I am 5,000 miles from San Francisco"? It would be impossible for any other ship to find it without some further direction. And so we have another very important way of marking position on the surface of the globe and on a map. We shall learn later that the earth is not still, but turns round once in every day (if it did not do this we should not have day and night); and then once a year the earth moves right round the sun. Now when the earth turns round, it rotates on its axis, once a day. We must see what we mean by the word axis. Look again at the school globe, or if you cannot do that, at Fig. 10. You will find that the earth turns round in such a way that there are two points which really do not move.

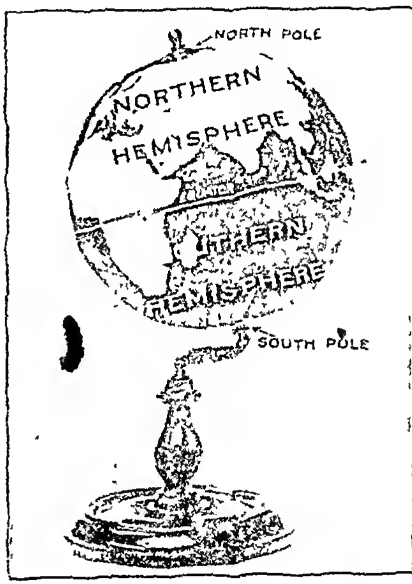


Fig. 10.—The Globe showing N and S Poles

These two points are the North and South Poles, and the axis of the earth is an imaginary line stretching through the centre of the earth between these two points You can hold a tennis ball between your thumb and your first finger and then twist it round, and you can imagine your thumb is touching the South Pole of the tennis ball and your first finger is touching the North Pole of the tennis ball, and you will see roughly how the earth turns round Now, running round the centre of the earth, half-way between the North and South Poles, we have an imaginary line. This imaginary line is called the Equator, and you can see that it divides the earth into two halves, two halves which, to use a long Latin name, are half spheres or hemispheres We have the Northern Hemisphere and the Southern Hemisphere. Now try and imagine yourself walking, if it were possible, from the North Pole to the Equator. You could divide the distance that you have to cover into a number of equal parts You could divide it into four parts or six parts, but for certain reasons which we shall see presently, the distance between the North Pole and the Equator or between the South Pole and the Equator has been divided into ninety divisions or ninety degrees. These are called degrees of latitude You can see that when [illegible] have walked ten degrees from the North Pole you [illegible] the highest [illegible]mall circle round the North Pole ten [illegible] high, an[illegible] it, and so we can divide up the [illegible] on [illegible]ch, as you see has been done in Fig. 11. [illegible] Equator 0, we can start numbering these degrees of latitude away from the Equator on either side, and you will see that on that

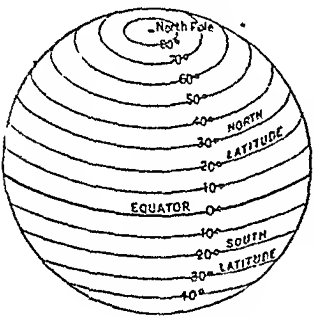


FIG 11 —Lines of latitude

figure has been marked 10 degrees north latitude, 20 degrees north latitude, and then again the same number of degrees south of the Equator. Now, if we find we have a place which is 52 of these small divisions away from the Equator on the north side of the Equator, or in the Northern Hemisphere, we can say that that place is in 52 degrees north latitude (which we write 52° N), and that expresses absolutely its distance from the Equator If we know that 1° is roughly equal to sixty-nine miles, we can very easily work out the distance in miles There is one point we ought to remember here that is, the earth is not quite a real sphere like a tennis ball It is very slightly flattened at the North and South Poles, and this results in a degree of latitude being slightly longer near the Poles than it is near the Equator.

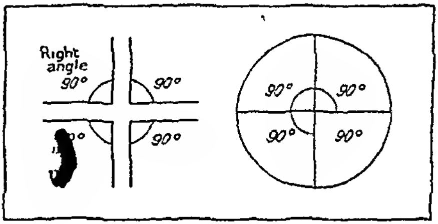


Fig 12

Now let us imagine ourselves on the Equator We can start from one point on the Equator and we can go right round the earth until we come to that point again We shall have gone round a complete circle, and actually we shall have gone about 25,000 miles If we could get ships to take us across the ocean and then travel across the land masses it would really be possible to do this. But when people travel round the world they do not as a rule go exactly along the line of the Equator. You all know from your geometry that there are 90° in a right angle, and if you put four right angles together, as in Fig 12, you will of course have four times 90°, that is, 360°. You will see then that a circle contains 360°, and if we walk right round the earth along the line of the Equator, we shall have walked through 360°. That is why we divide the Equator

[illegible] to [illegible] parts, each of which is a degree of longitude But [illegible] thing is at what point on the Equator should [illegible] Fortunately most nations of the earth have [illegible] starting point and have drawn a line from the [illegible] to the South Pole across the Equator, and [illegible] through a very famous building in London, the [illegible]tory at Greenwich, where there is a very large [illegible]pe through which the stars are watched regularly [illegible] staff of men. This line of longitude passing through Greenwich is called longitude 0, or the meridian of Greenwich Through each of our 360° round the Equator we can draw a similar line passing through the North and South Pole and a point on the Equator. Each of these is called a meridian of longitude, and we number the lines of longitude east and west of the lines passing through Greenwich, so that we get 1 up to 180 on one side and 1 up to 180 on the other And the longitude of 180° is exactly on the opposite side of the earth to the meridian of Greenwich In Fig. 13 you see a sphere on which every 10° of longitude has been marked. Now the reason why we divided the distance between the North and South Poles and the Equator into 90° will be quite clear to you, because if we go round the earth from the North Pole across the Equator to the South Pole, then across the Equator the other side to the North Pole, we shall have again passed through a complete circle, that is through 360°. Now let us put the lines of latitude and the lines of longitude on the same drawing of a globe and we get an appearance such as is shown on Fig. 14, and we see at once that we have a way of pointing out

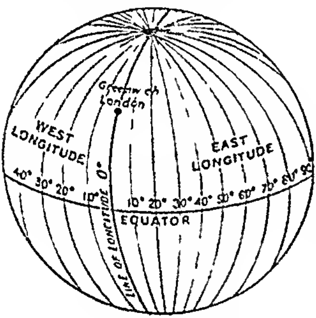


FIG. 13 —Lines of longitude

any spot on the earth's surface If we return now to our ship in distress in the middle of the ocean, that ship can send out a message that it is in latitude 10° north and longitude 165° east and its position can be marked exactly on a globe or a map which has only marked on it lines of latitude and longitude

Now let us for a moment return to our map The earth is really a sphere or a globe, but a map is drawn on a flat piece of paper. If you carefully remove the peel from an orange, you will find that you cannot spread that peel

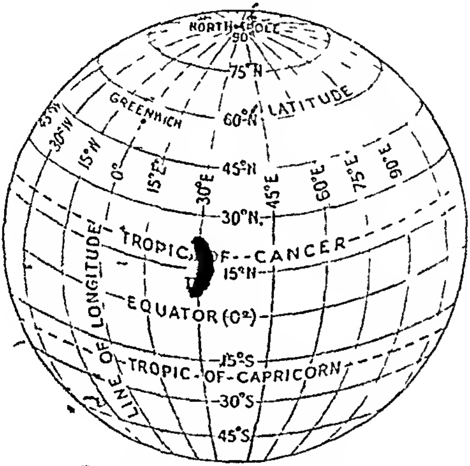


FIG 14.—Diagram of latitude and longitude

out to make it flat without it splitting all round the edges So, too, if we try and fit a flat piece of paper round the school globe, we find that we shall have to crumple it up. We cannot, therefore, have a map on a flat piece of paper of a large part of the earth's surface which is really a true picture We have to employ what are called map projections

Before we leave this section there are one or two other things which we ought to remember. We have found

out that the earth is a great ball floating in space, the moon is a smaller ball which moves round the earth The earth and the moon together in their turn move round an enormous ball of gas and flames which is the sun, millions and millions of miles away, actually over 92 million miles away from us, but from which we get heat and light The light which we get from the moon is really only the reflection of the sun on the moon

So we see the earth has two important movements · it turns round on its own axis once every day, causing day and night, it moves round the sun once in every year, causing the seasons

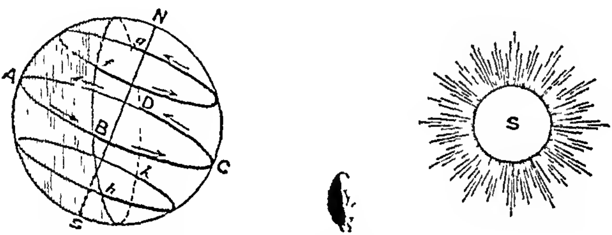


FIG 15—How day and night are caused The shaded part of the earth (away from the sun's light) represents the night. The arrows show the direction of the earth's rotation

The earth is so large that to us living on the surface it seems to be fixed We say the sun rises in the morning and sets in the evening But really the sun is fixed and it is the earth which moves round on its axis The sun appears to rise in the east and set in the west, that is because the earth rotates on its axis from *west* to *east*, as the little diagram shows.

Now notice your school globe You will find the axis of the earth is not placed in an upright position but sloping to one side We call this the inclination of the earth's axis, and when the earth moves round the sun, which it does once in a year, the earth's axis is always inclined in the same direction This is very important. Perhaps you

best understand it by imagining the sun to be in the [illegible]e of your class-room, and you can then move the [illegible]light round the room You will thus imitate the [illegible]rth's movement round the sun, but be careful to keep the axis of the earth always inclined in one direction. When the globe is in the position shown in Fig 16, you will be able to find a spot which is directly facing the sun—on which the sun's rays shine vertically Rotate the earth and you will find a line along which all places come directly under the sun once a day When this line is as far to the north as it is possible for it to be, we have our midsummer day in England (June 21, called also the summer solstice), for then the sun is shining vertically not so very far south

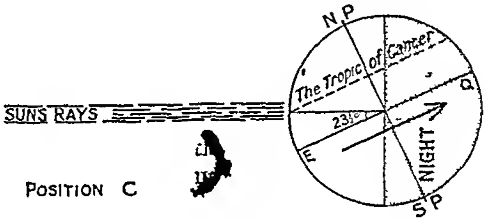


Fig 16

of England, and even to us he appears very "high in the sky." The line traced out on this day by the belt of vertical sun is called the Tropic of Cancer Notice from Fig. 16 that there is a part of the earth's surface round the South Pole on which the sun does not shine at all at this season of the year. Indeed, all places within the *Antarctic Circle* have one day at least in the year on which the sun never rises. But places around the North Pole have continuous daylight—in the lands of the midnight sun there is no night in the summer.

Now we can find the position when the sun is shining vertically in lands far to the south of the Equator. This is in our winter (when it is summer in Australia and other lands south of the Equator). On December 22 (our mid-

winter or winter solstice) the belt of vertical sun tr...
out another line—the Tropic of Capricorn—and on ...
...coun

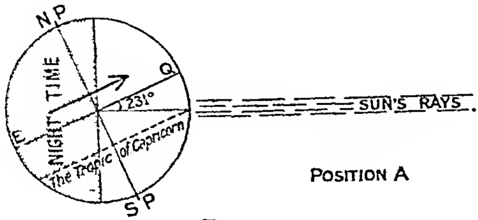


FIG. 17.

it is dark (the sun does not rise) at all places inside the *Arctic Circle.*

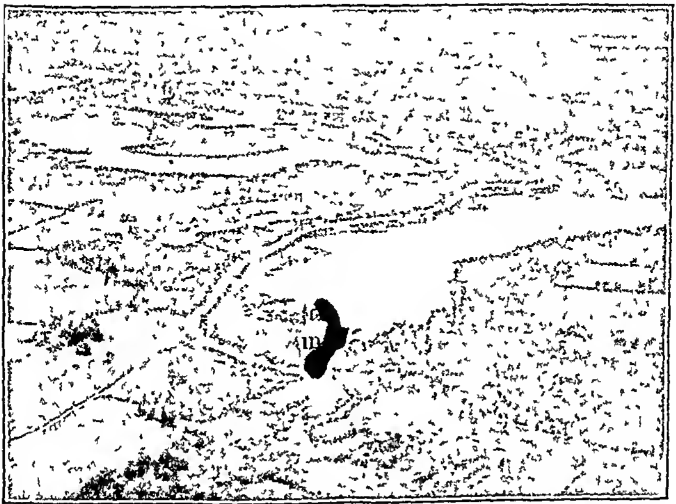
SECTION III

THE SURFACE OF THE GROUND

LET us now see what we know about the surface of the land. Wherever we live we know that it is not always the same. There are some places which are flat or level, there are some places which are hilly. Even if we live in the middle of a big city, we can tell this because the roads go slightly uphill. Perhaps many of us have never seen high mountains which rise thousands of feet, but we can all imagine, at least partly, what they look like. It is not difficult to understand also how the surface of the country affects the life of man, for where there is flat land or gently rolling land, it is not difficult to build houses, and so villages and towns arise. On flat land, too, we can easily construct railways and roads. But if you can imagine a land full of giant mountains it would be very difficult indeed to build houses on the mountain sides, and indeed there would be few reasons for building

d here It would not be possible to cultivate the
... und about, and so we find that mountainous areas
) have few people, or as we say are thinly inhabited,
e u flat lands or valley lands often have very many
people indeed

Let us first see how many different kinds of surface we know. First of all there is a plain or very flat country



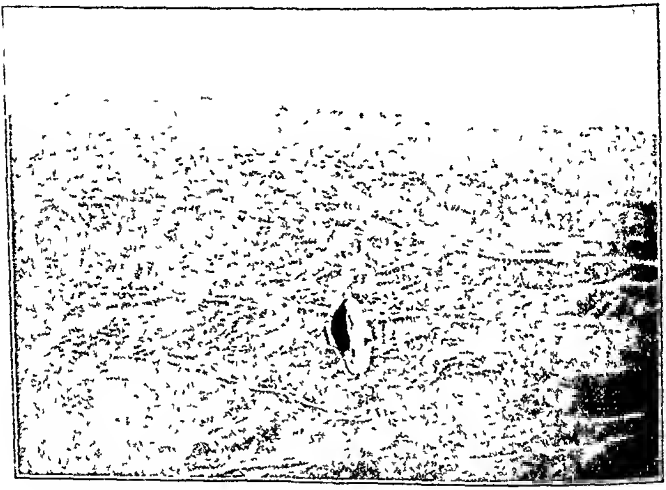
[Photo Central Aerophoto Co, Ltd

FIG 18—Photograph, taken from an aeroplane, of a plain, with a river meandering across it, and in places flooding the lower land.

Very often the plain is on either side of a river and, as we shall see presently, is due to the deposition of mud and sand by the river, and so we call it a river plain Some of you may know streams near your own house where there are flat meadows on either side. These meadows often become flooded in the winter months when the stream is full of water, and so they form a flood-plain of a river. But not all plains are quite flat: some of them are

undulating or gently rolling land, such as the great plains which occupy central America

Then we have hills or hilly country, where the land rises only gently and to no very great height, perhaps as much as 400 or 500 or it may be as much as a thousand, feet Then there are *mountains*, where the land rises to much greater heights and the sides of which are very

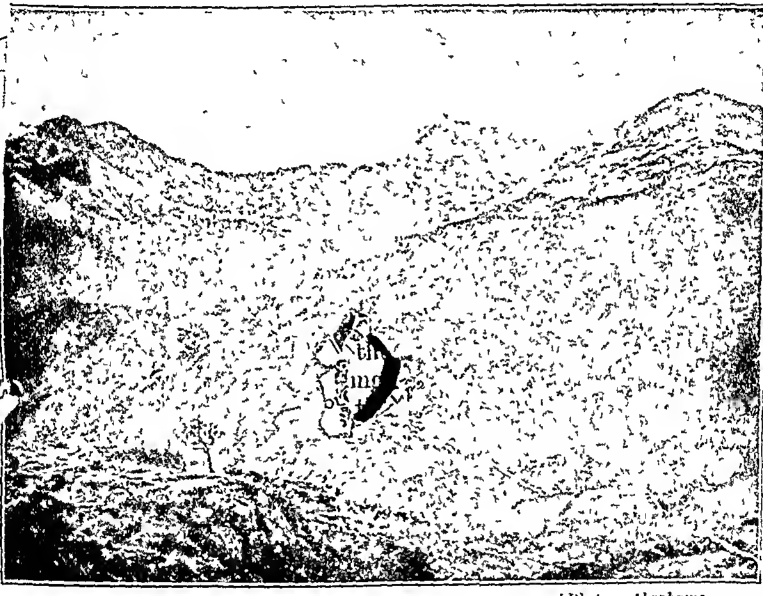


[Courtesy South African Railways

FIG 19 —Photograph taken from an aeroplane A country consisting of a large number of small hills

much steeper. We do not usually talk about a mountain unless it rises to at least a thousand feet above the level of the sea. But we cannot very easily have hills or mountains rising high above the general level unless we have the individual hills or mountains separated by hollows These hollows are the valleys, and usually the valleys are occupied by rivers Sometimes a valley is broad and open, some valleys, if you tried to draw a section of them,

d t be U-shaped, in others the river has cut a deep ere and so they are V-shaped Then there are many) which are deep and narrow and may be very rocky rm gorges In some valleys the sides are very, very steep indeed, and the river lies right at the bottom of a very deep hollow, which in that case we call a canyon



[Photo Abrahams

FIG. 20 — A view of mountainous country, with the tops of the mountains snow covered

Then again we may have areas of the earth's surface which are flat, or almost flat, like the surface of a table above the surrounding level We call such elevated tracts plateaus

Before we go any further let us be quite sure we understand some of the simple geographical terms which are

in common use. Of course we all know what an is[illegible]he a piece of land cut off from the larger masses a[illegible] rounded by the sea, or by water Sometimes such [illegible]

[Photo U S. Government

Fig 21 —A river flow[illegible]ugh a deep canyon.

of land is not quite surrounded by water, it then forms a peninsula, and the narrow neck of land joining it to the

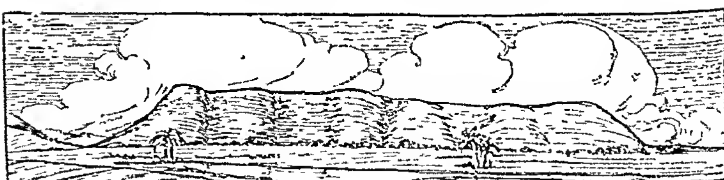
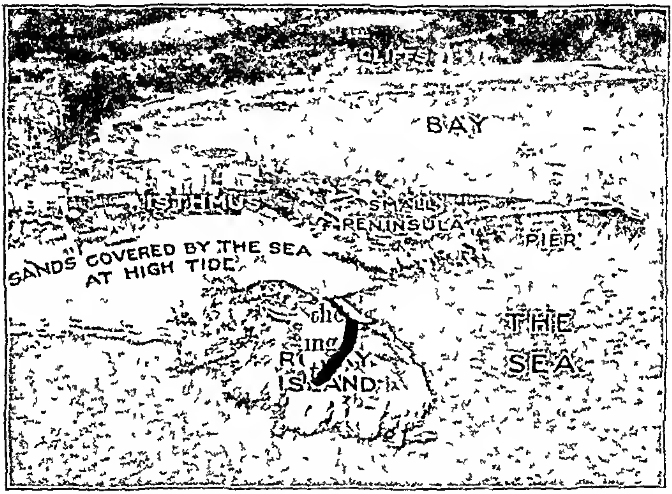


Fig 22 —Diagram of a plateau

larger mass is called an isthmus. Pictures and a little map will help you to understand some more of these terms A piece of land which juts out into the sea is called a cape

d to land, whilst when the sea occupies a hollow in the eren is said to occupy a bay or a gulf. Then, of course, l) C at land masses of the world are called continents, the greatest masses of salt water form the oceans. A smaller area of salt water forms a sea There are a few terms also which you must remember in connection with rivers. Where a river commences there is very often a



[Photo Aerofilms, Ltd

FIG 23 —A photograph taken from an aeroplane.

little spring of water bubbling up out of the ground, called its source Where it enters the sea is its mouth. In its course from its source to its mouth, a river is joined by smaller streams, which are called its tributaries, and very often before it reaches its mouth or the sea the river breaks up and actually reaches the ocean through a number of different channels. that is to say, the river breaks up into distributaries instead of reaching the ocean as one large stream. A river and its tributaries drain the water

away from a large tract of land, and the whole of th

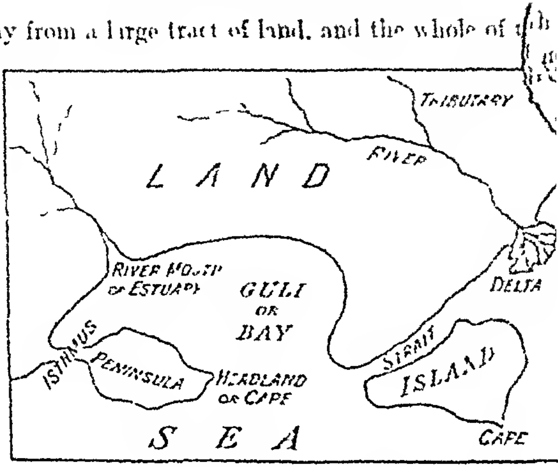


Fig. 24.—A map showing an island, a peninsula, etc.

which it drains in this way is called the basin of the river.

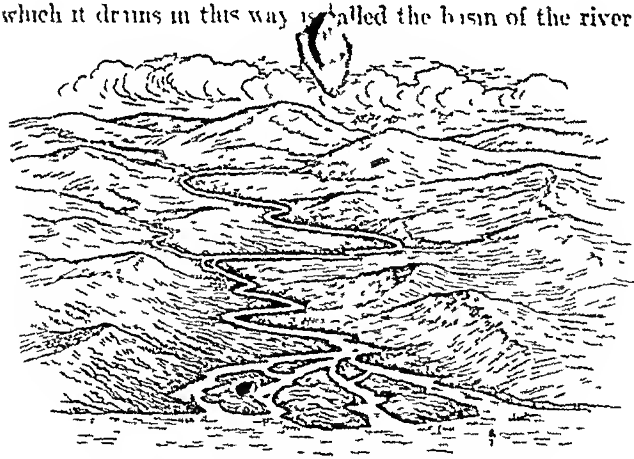


Fig. 25.—A river basin.

Sometimes the river broadens out and occupies a hollow

surrounded by land, and this tract of water then a lake. Most lakes have a river draining into them, [illegible]o an exit with a larger river draining away But [illegible]are lakes or inland seas which have no outlet in this

FIG 26

In the last section we [illegible]t something about maps. But a map is a flat piece [illegible]per, and we must have some way of showing on it hill[illegible]ountains, and valleys There are several ways of doing this One is to make a model of the country and then to photograph the model But this only gives a very general idea of the country, as you see in Fig. 26. Another way is to use what are called "hachures" Hachures are plain or broken lines running down the slope of the hills, thick and close together where the slopes are steep. Fig 27 shows you a mountainous island with two peaks. This is not a very good method, for various reasons; one is that the hachures often hide the names printed on the map.

FIG 27—Hachures

The best method of showing physical feature th contours A contour is an imaginary line passing th all points at the same height above sea level. could walk along a contour line you would thus neither uphill nor down you would go round all hills at the same height Or think another way: i sea rose everywhere 100 feet above its present lev places less than 100 feet above the present level of t would be covered with water. We should have coastline, and this coastline would be the same present 100-foot contour Similarly, we can imag

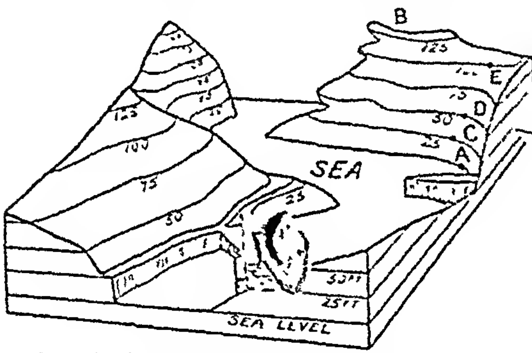


FIG 28.—Diagram showing the meaning of contours

sea rising 200, 300, 400 or 500 feet, and giving us new coastlines one after the other, following along what are now the contours. Contoured maps can be made even clearer by colouring the land differently according to its height Usually lowlands—for example, lands up to the 500 feet contour—are coloured green, lands above that yellow or brown

Fig. 29 represents an island with contours shown. Below it is a section Notice very carefully how it is constructed

We sometimes talk about the everlasting hills, but actually there is no part of the earth's surface that is

...ing, and in reality changes are going on all the ...erent. You ought now to know something about the ...1) C...s which are taking place on the surface of the earth ...aps we can say at once that the changes are of three ...n kinds:

...1) There are the slow changes which are taking place ...ost continuously. Whenever a shower of rain falls ...ashes away some of the soil, and that soil is carried

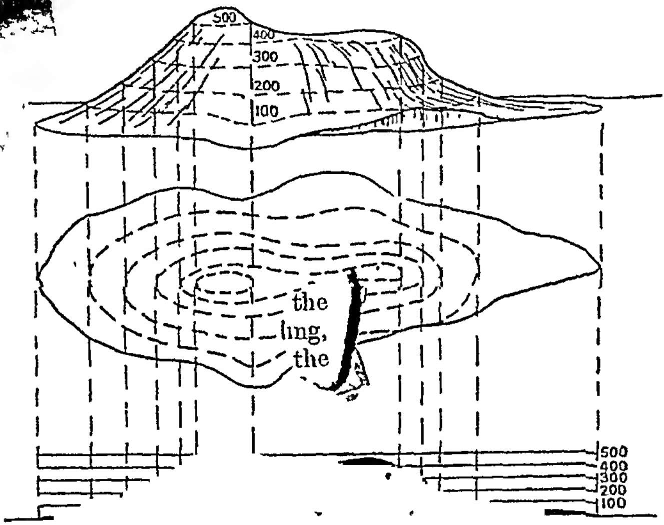


FIG. 29.—A contoured drawing, map and section

by streams and rivers to another part of the earth's surface and very often is there deposited.

(2) Then we read in our newspapers of earthquakes and sometimes of volcanoes erupting. These are sudden changes which take place on the earth's surface

(3) Then there are slow changes of another character. Some parts of the earth's surface are rising gradually, other parts are sinking gradually. Let us take each of these groups of changes in turn.

The slow changes due to the gradual wearing away of the surface.—

As soon or even before dry land is formed above the surface of the waters of the ocean there are many different agents which are waiting to attack that land and to wear it away:

[Photo L D Stamp

FIG 30 —An earth pillar in the dry belt of Burma

The rain has washed away the soft sand and pebbles except where they are protected by a mass of hard sandstone

(1) *Rain.*—We have nearly all of us seen what can happen after a heavy shower of rain. The water, pouring down as big drops on to the earth's surface, will wash away some of the loose particles of soil, and we know how even the gutter at the side of the road can be full of mud after a rainstorm. In very dry countries where rain does not fall very often a single rainstorm may often do a great deal of damage, and may descend on soft sand or soft sandstone which can very easily be almost completely washed away except when protected by hard stone or a hard mass of rock. Look at the picture, which was taken in a dry country, and you will see how a mass

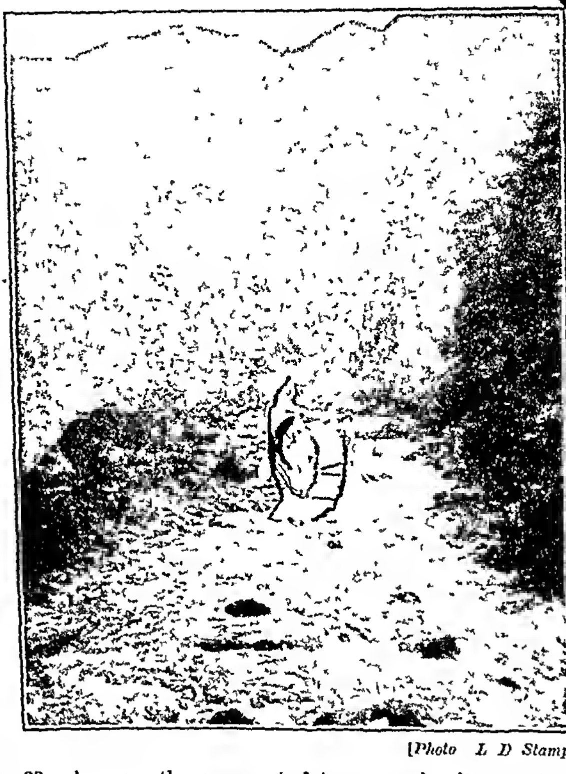
l rock can protect the soft sand underneath and t these sands from being washed away by rain, but d the hard rock the soft sand has been removed, o we get standing what is called an earth pillar. s shows very clearly what a large amount of sand must

[*Photo* *L D Stamp*

FIG 31 —A cave or cavern

have been removed by rainstorms. Then the rain, passing through the atmosphere, has dissolved certain gases, particularly one about which we shall learn presently, called carbon dioxide Rainwater which has carbon dioxide in solution is capable of actually dissolving certain different kinds of rock, notably that called limestone. In limestone

districts the rain sinking into cavities in the soil dis[...]e some of the rock And this is the way in which [...] large caverns have been formed underground.



[Photo L D Stamp

FIG 32—A river in the upper part of its course, when it is running very swiftly.

(2) *Running Water*—During and after a rainstorm the little raindrops when they reach the surface of the earth join together; and so you see that a tiny stream can be formed which may be running down the side of a road or

'd to a field. The little stream is muddy because it erent with it some of the mud which has been removed 1) Co the roadside, and the mass of water itself moves more—it may be mud sand, and perhaps even small nes Then the little streams join together and form a river, and we may see a big river full of muddy water sweeping along and gradually eating away its own banks. Thus a river really works in three different ways First, as an agent of denudation a long word which means the "laying bare" that is to say, it washes away the soil and lays bare other parts Then the river sweeps along the mud with it, that is to say, it acts as a carrier or a transporter: we call that the transporting work of the river; and then near the mouth, where the speed of the current is much less, the river is no longer able to carry its burden of mud and sand and so deposits it there, and reaches the sea through this area of deposited land called a delta. Here its work is deposition.

(3) *Frost and Ice.*—The k of frost and ice is very important in cold coun the d in countries which have a cold winter, as our ling, ountry has Have you ever noticed the happens to a jam-jar which has been of water and has been left outdoors on a cold frosty day? The water inside has been turned to ice, and when water changes to ice it expands and grows larger, and the result has been that the glass jar has been split. Sometimes we have frosts so severe in this country that the water in our water pipes freezes and the water there expands and bursts the pipes. When the thaw comes again and the ice changes into water we find that our pipes have burst and are leaking Now try to imagine what happens on mountain and hillsides. The rainwater gets into small cracks in the rocks, then the frost comes and the rainwater freezes. When it freezes it expands and so the crack is widened. Later other frosts will widen the cracks still

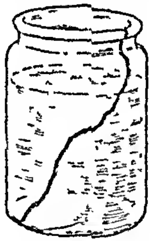


FIG 33

more till last of all a big angular fragment of rock is broken off from the main mass and such pieces tumble down from the mountain or the hill into the neighbouring valley That is why nearly all mountains where it is very cold consist of jagged, angular rocks They are jagged because of these sharp pieces which have been

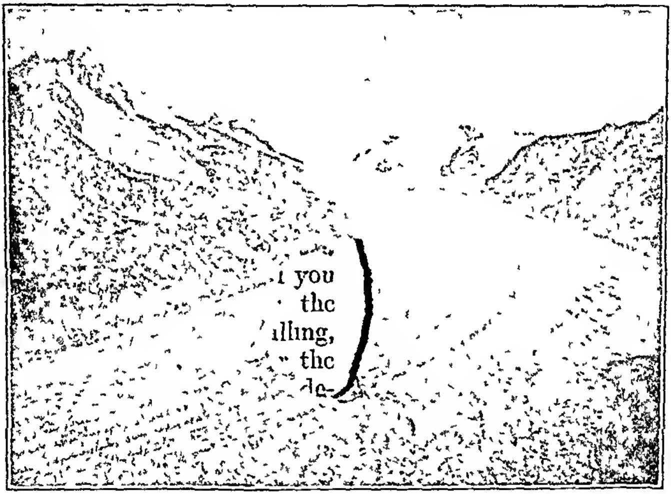
[Photo Canadian National Railways.

Fig. 34 —A scree of sharp stones, broken off by frost action.

broken off by frost action. Then at the base of such mountains in the valleys we see enormous piles of stones all of which are sharp edged, and these piles we call screes The screes have been formed by frost action. Of course some of the blocks of stones broken off by frost action may fall into the valleys and be carried down towards the sea by the rivers, and in that case the stones

y become rounded by being rubbed against one and the sharp edges are worn off.

ne countries or in very high mountains it is cold all the year round for there to be no rivers. Instead ers we have frozen masses of ice which we call glaciers Glaciers then are really frozen rivers Just as a river flows down a valley so the glacier flows down a valley It is gradually fed from behind by masses of snow and moves, it may be very slowly, down the valley But you



[Photo Exclusive News Agency

FIG. 35 —A glacier

can imagine that a great heavy mass of ice flowing even slowly down a valley must have a great effect It smoothes the hard rocks over which it passes, and very often scoops out hollows in the floor of the valley.

Instead of having a valley like that of a river, with the river flowing at the bottom of a V-shaped section, a valley which has been occupied by a glacier is U-shaped. Ice cannot flow from side to side like the waters of a river, and so we find these glaciated valleys are long and straight instead

of winding from side to side and having spurs like a valley. Look at the pictures very carefully to see. A glacier is often helped in its work of wearing a valley by the great stones which are broken off from sides of a valley (often by frost action) and which down deep cracks in the ice, or, to use the proper name for these deep cracks, into crevasses There they reach the bottom and become frozen into the base of the glacier so that the ice, as well as smoothing the rocks over which it passes, is armed with great hard masses of stone, which do still more damage by scraping away the floor of the valley Stones which are broken off and are carried down by the glacier in this way whether frozen into the bottom

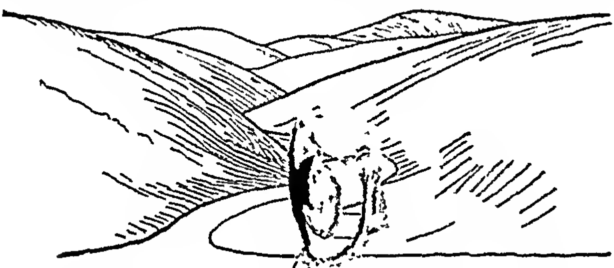
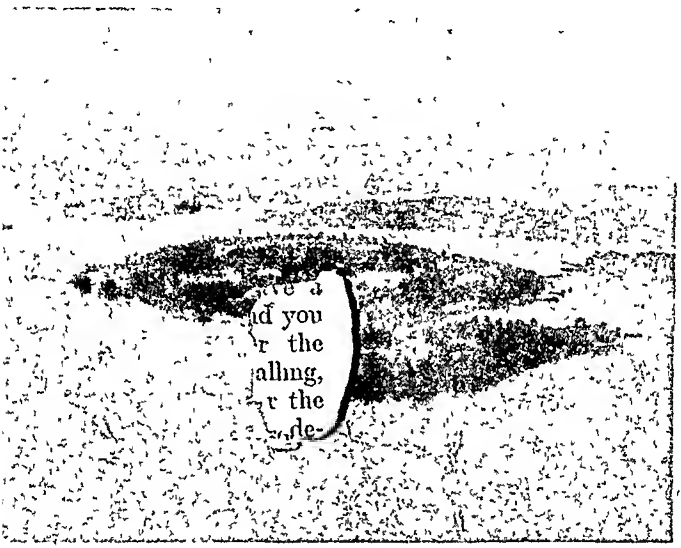


FIG. 36 —Diagram of a river valley with interlocking spurs

or just lying on the surface, we call moraines. When a glacier reaches lower levels or reaches warmer tracts of air the ice, of course, melts, and so we usually find issuing from the end of a glacier a river. This river will carry with it some of the sand, mud and stones brought down by the glacier, and so we often get spread out in front of the glacier where it is melting a great mound of glacial deposits, as we call them.

Then, besides the glaciers which occupy valleys, some of the very cold countries are covered by an enormous sheet of ice. Look at the map and find the country of Greenland. Practically the whole of Greenland is covered by an enormous mass of ice, in some places more than

'd to et in thickness. The same is true of one of those
erent ts of which we spoke some time ago, the continent
1) Co etica, which is situated all round the South Pole.
most entirely covered by a great sheet of ice. Long,
ago many parts of the earth's surface were very much
older than they are to-day and our own country, the
ritish Isles, was at that time covered with several sheets



[Photo L D Stamp

IG 37 —View taken from an aeroplane of a country built up of hard rocks, which has been smoothed by a great ice sheet The hollows are now occupied by the sea, and the hummocks form islands

f ice. We call this period the Great Ice Age, and we still ave scattered over many parts of England great blocks f stone brought by these glaciers, and many mounds of and and of clay (often full of great stones) which were aid down when the ice melted All these we call glacial eposits. And if you live in the north of England you nay have seen great stones scattered about which have

...d to in China are almost completely covered with this ...eral Look at the picture of the sphinx which is given (1) Co... last page It is a monument made many thousands ...ears ago by men in the dry desert regions of Egypt, ... since it was carved out of the hard rock many storms of wind blowing particles of sand from the desert have gradually worn the sphinx away. You can see this quite clearly if you study the picture

(5) *The Sun*—Then there is the work of the sun in wearing away the surface of the earth This at first seems strange—but the work of the sun or, as we call it, insolation, is important in very hot countries, especially in hot, dry countries. During the day the sun shines down on masses of rock and makes them very hot indeed, so hot that you could not possibly stand on them. Then at night time, after the sun has set, the earth gets quite cold and the rocks get cold too. Now ...en many things are heated they expand, but they ...ve a ... expand or grow larger at the same rate, and so ...d you ... minerals, or substances of which a rock is com...r the ... not always expand at the same rate when they ...alling, ...d by the sun during the day. Some grow larger ...r the ... quickly than others, and in so doing they split the ro... and so we often find in hot tropical countries that layers or sheets of rock are actually split off by the action of the sun

(6) *The Sea*—Last, but not least, we have the action of the sea. Most of you, no doubt, have been to the sea-side and you know that sometimes in rough weather there are great waves These waves beat against the shore, and even where a strong promenade has been built by man the waves are often able to do a great deal of damage. Not only is there great force from the water, but the waves pick up masses of stone ... shingle and in rough weather throw these against the cliffs or the shore and so wear them away. When we pass to the British Isles we find high cliffs, such as the chalk cliffs of south-eastern England, which have been worn by the sea in this manner There is no doubt that once the British Isles were joined

to the Continent of Europe and that the chalk stretched right across from south-eastern England—Dover—to the north of France; and gradually the sea worked hard and has cut a passage between the two so that we now have the Straits of Dover separating England from France. Not only can the work of the sea make high cliffs in this way but the masses of stone which are broken off by the action of the water are beaten against

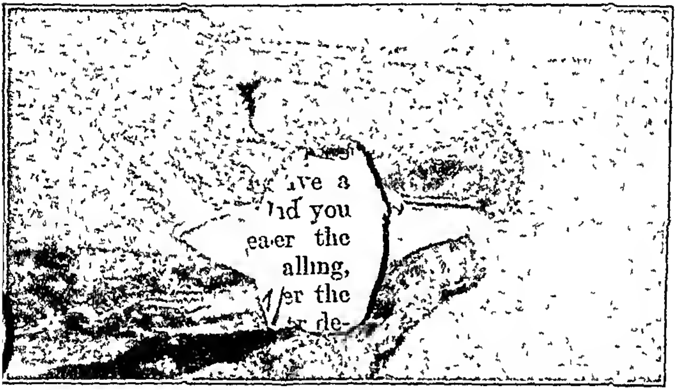
[Photo Topical Press Agency

FIG 39—A picture showing how the sea has eaten away the cliffs during a storm and destroyed some beach huts

one another and are turned into those round pebbles which we can see on almost any sea beach. Pebbles are often ground so finely that they form the fine sea sand which occurs on many of our coasts. The shingle and the sand are washed along the sea shores from one place to another, so that we often find pebbles which must have travelled a very long way. But the action of the sea does not extend down to any great depth. Even in the fiercest storms it is possible to dive down where the sea is very

...d to ... find the water quite still So where wave action ...erent ...t round the coasts the sea cuts out what we can ... 1) C...atform. The result is that round many countries ...orld there is an area of shallow sea, a sort of shelf, ... the Continental Shelf We shall learn about the Continental Shelf surrounding the British Isles at a later stage.

In the deep, tranquil or quiet parts of the sea many small animals live, and when they die their remains fall to the bottom and form there a deposit. Mixed up with



[Photo Air Views, Ltd

FIG 40 —Cliffs and a deep bay or cove worn by the sea

these remains of animals we find particles of mud: and so, forming at the bottom of the deep ocean very slowly, we get deposits of such things as mud and the shells of small animals

We have now learnt about the principal slow changes that are taking place over the surface of the earth. There is the work of wearing away, or denudation, the work of carrying material from one part to another, or transportation; and the work of placing that material such as the sand and gravel and mud or depositing it in a new place,

which we call deposition We must now learn so[illegible] about the quick changes which take place on th[illegible] surface caused by earthquakes but before we do [illegible] us learn a little about the inside of the earth, [illegible] underneath the ground

SECTION IV

UNDER THE GROUND

We have now learnt something about the surface of the earth and we must try and see what lies underneath; for really the appearance of th[illegible]ce, whether it is a plain or whether it is mounta[illegible]ntry depends on what is underneath The sol[illegible]e earth on which we stand is called the earth[illegible] find that if we dig a deep mine it gets very [illegible] as we go downwards from the surface, and at a [illegible]out a mile or perhaps two miles, it would be so [illegible]t it would be difficult for men to work. So we believe that lower down there must be a layer in the earth's crust that is so very hot that almost all the rocks would be melted, and it is from these lower layers in the earth's crust that the molten rock comes up which is poured out as lava from volcanoes A long time ago men used to think that the interior of the earth must therefore be a liquid mass, but we know that is not the case, and very probably the centre of the earth consists of a great solid ball almost entirely made up of iron.

How can we learn something about the interior of the earth's crust? It is often only in a few places that we can see of what it consists Where we have cliffs round the sea coast, and where man has made pits or quarries we can see what underlies the surface A new railway

d to may show us something, and even sometimes when erent house is being built and it is necessary to cut out 1) Co foundations, or when a new sewer is being made in e ad we can find out something about what lies under-th We know that sometimes the materials that are dug up in this way are soft, such as clay or sand or gravel, in other places they are harder, such as chalk, whilst in still other places they are very hard rocks, such as the granites and the limestones that are often used in building Now the geologist, as the man is called who studies the structure of the earth, has one name for all these materials, whether they are hard or soft, he calls them all *rocks* So when in this book we talk about the rocks of the earth's crust you must remember that they may be of hard or soft materials.

The geologist has found that there are four great classes of rocks that make up ! urface of the earth So let us look at each one of ve a

(1) **Sedimentary** nd you called stratified rocks We have learnt alreaer the hy in which rivers work alling, er the r de-

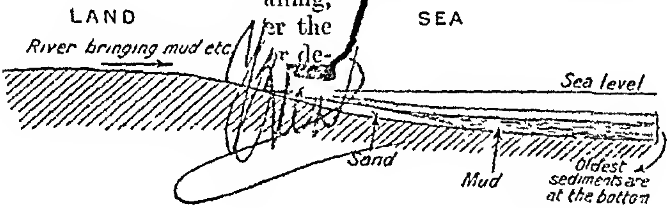


FIG. 41.—Diagram to illustrate the formation of sedimentary rocks

by wearing away a part of the land, carrying down sand or mud, and then depositing that sand or mud when the river reaches the quieter waters of the sea or flows into a lake And so we get layers of "sediment" which have been formed in this way. (The layers will naturally be spread over a wide area of the floor of the sea or lake, and we call such layers strata. This is a Latin word, so that the singular is "stratum") You will see at once that

the stratum at the bottom is the oldest, sinc[illegible] deposited first on the floor of the sea or of the la[illegible] can see, too, that if there are any fish or other [illegible] living on the floor of the sea and they die, they [illegible] to the bottom and may get covered up by the sand [illegible] mud brought down by the river. You can think then of the floor of the sea being covered by layers or strata of these different *sediments*. Now imagine an earthquake or a series of earthquakes. Earthquakes often cause some parts of the land or sea to rise up, other parts to sink down, and so the whole series of sediments which have been laid down on the floor of the sea may be raised up to form dry land. Even at the present day when we have severe earthquakes this sometimes does happen. When sediments which have been laid down on the [illegible] of the ocean or of the la[illegible]adually lifted to form d[illegible]e shall be able to say t[illegible]land is composed of se[illegible] *rocks*. We can prove tha[illegible]nd has once been under the [illegible]ecause we shall find the remains of fishes or other creatures, or at any rate their hard parts—their bones—have been preserved in the midst of the clay or the sand. These remains of creatures that once existed are called *fossils*. We get fossil shells, fossil fish, and fossil plants in some of our rocks. But when an earthquake or a series of earthquakes causes the floor of the sea to rise with its sediments in this way, as a rule it does not rise [illegible]eadily. One part rises more than another, and so we get the strata of the sediments crumpled or folded. You will learn something about these folds presently.

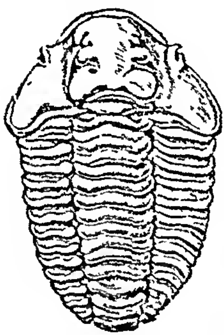
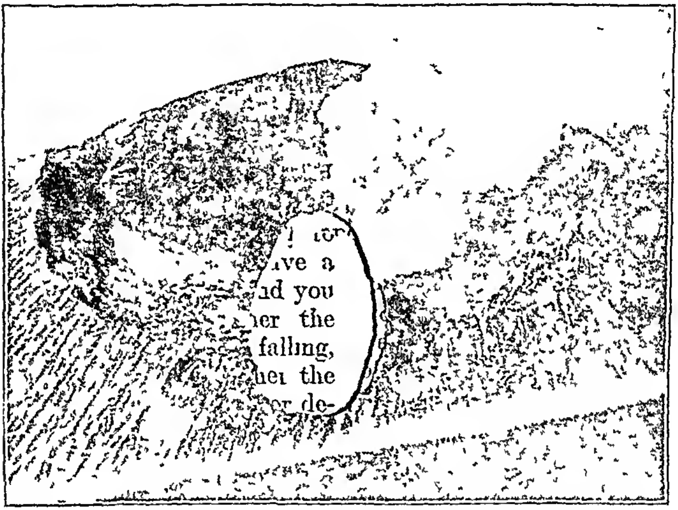


FIG 42.—A fossil [illegible]

(2) **Igneous Rocks.**—The word "igneous" comes from a Greek word *igne*, meaning fire, and so igneous rocks are

d to the fiery rocks, or those rocks which have been in erent ted lower layers of the earth's crust. I think all 1) Co must have seen pictures of a volcano A volcano o be called a burning mountain, but this is not at correct. A volcano really marks a hole or crack in the earth's surface through which some of the molten rocks from deep down can come up and spread over the



[Photo Aerofilms, Ltd

FIG. 43.—Photograph taken from an aeroplane of an active volcano showing clouds of steam coming from the centre of the crater

rface. Sometimes the lava or molten rock comes up adily, almost like a stream of water, at other times it mes up with great bursts of stea and smoke, and large locks of rock or fine pieces, called ashes, are thrown out And so we may get a volcano building up round itself a cone of ashes and lava We see one in the picture But in other places the molten rock may just spread evenly over the surface of the ground In this case we get

4

considerable areas of the earth's surface covered particular type of igneous rock which we call rock

But in many parts of the world although there be these molten rocks underneath there are no crac... through which they can reach the surface. The molten rock forces its way up as far as it can and sometimes almost reaches the surface, and may for that reason cause earthquakes But before it actually reaches the surface the molten rock ceases to move and gradually becomes cool and solidifies and so we may get igneous rocks which have been formed in this way without reaching the earth's surface You may say, how do we know they are there ?

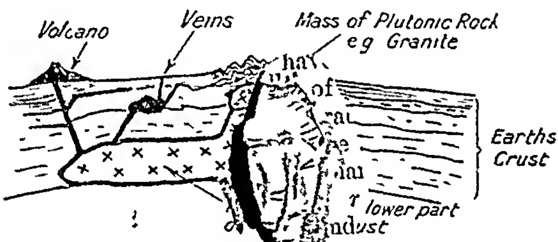


FIG. 44 —A section through the earth's crust showing different types of igneous rocks

Do not forget the agents of denudation—the rain, the rivers and the frost and so on—that are continually wearing away the earth's surface They often wear away so much that they will bring to view these igneous rocks which have solidified slowly underground. You have nearly all seen granite Granite is a very good example of a rock that has been formed in this way. When you have a opportunity look closely at a piece and you will see that it consists of quite large crystals These crystals have been able to form because that rock, once molten, was able to cool slowly underground Try and see how many different kinds of crystal you can see in a piece of granite. Igneous rocks, both volcanic rocks and these, which have

[illegible] d to [illegible] ll deep down in the earth's crust and which we [illegible] nic rocks are important to the geographer Very [illegible] (1) Co[illegible] lcanic rocks after a little while weather quickly [illegible] m a very good soil, and many of the richest agri- [illegible] al regions of the world are on old volcanoes That is one reason why people although it may be dangerous, often go and live in volcanic regions. The plutonic rocks are important to man in many ways The granites form very good building stone, but are also very important because when this molten material comes up from below it brings with it the ores of many of the *metals*. The ores of gold and silver, of copper, tin, lead, zinc and many others have come up as a rule from the interior of the earth in this way, and so we often find in regions where plutonic or volcanic rocks are common there are important mining areas.

(3) **Metamorphic Ro**[illegible] This is another long word derived from Greek wo[illegible] [illegible] ely *meta*, which means a change, and *morphe*—f[illegible] [illegible] refore means rocks which have changed their for[illegible] [illegible] ou will see that when hard rock is melted it mus[illegible] [illegible] ery hot indeed, and as it comes up from the lo[illegible] [illegible] f the earth's crust it must do a great deal of da[illegible] [illegible] the other rocks through which it passes It heats them and changes them into something quite different from their original form. You know what happens when clay is taken and moulded to form bricks It is put into the kiln, it is burnt into a brick, and is then something quite different from the clay from which it is formed. So if you have hot volcanic rocks passing over a bed of clay, they turn that clay into something hard and quite different. Similarly, too, when earthquakes cause great pressure and great folding in the earth's crust the rocks may be changed by the high pressure into something quite different And so we have this long word "metamorphic" for those rocks that have been changed in this way. These metamorphic rocks are often very hard, and so you will find they resist the action of rain and rivers, and so stand up as mountain chains on the

earth s surface or as high land. A very good exa[illegible] a metamorphic rock which you have all seen is [illegible] Slate was once just ordinary soft clay, but by great p[illegible] it has been converted into hard rock which splits easily in a certain way, and that is why it is very u[illegible] or roofing our houses.

(4) **Organic Rocks.**—This word means that the rocks have been formed from organisms, or animals and plants. Suppose you think for a moment of the quiet parts of the great seas or oceans. There are no rivers flowing into them, and so there is no mud, sand or other sediment There are living in the surface waters of the ocean, far too small for us to see, millions and millions of tiny creatures which build up a hard shell of material very like chalk When these tiny creatures die they fall to the bottom of the ocean, and gradually, but very slowly, the hard parts give rise to a rock which is f[illegible] entirely of the remains of these tiny animals The[illegible]at have sounded (that is, have found the depth[illegible] [illegible]eat oceans and have brought up samples from th[illegible]m, find these forming at the present day, and ha[illegible]em oozes; and you can see that if the floor of[illegible] covered with these oozes, is raised up to form [illegible] we shall get a rock of a rather peculiar character A rock actually formed in this way is the familiar white chalk so common in the south of England.

Then we have rocks which are formed from the remains of plants. You have all heard of, if you have not seen, peat, and you know that in boggy places moss and other plants will grow and then die, and other plants will grow on top, and gradually a thick layer is formed which th[illegible] poor people in country districts—for example, of Scotlan[illegible] and Ireland—dig out and burn instead of coal. P[illegible] then, is an organic rock formed of the remains of plants But still more familiar is a rock formed of the remains of forests which existed millions and millions of years ago: that rock is the coal which all of us know The forests grew and then were covered by masses of sand and

rought down by rivers after an earthquake, and so l seams were formed from which we get the coal at esent day. Two good examples, then, of organic are certain limestones formed from the remains of mals, and coal formed from the remains of plants

In the last chapter we learnt something of the slow changes which are taking place as the result of rain, rivers, frost and ice But there are also those changes of the earth's surface which take place in a different way, namely,

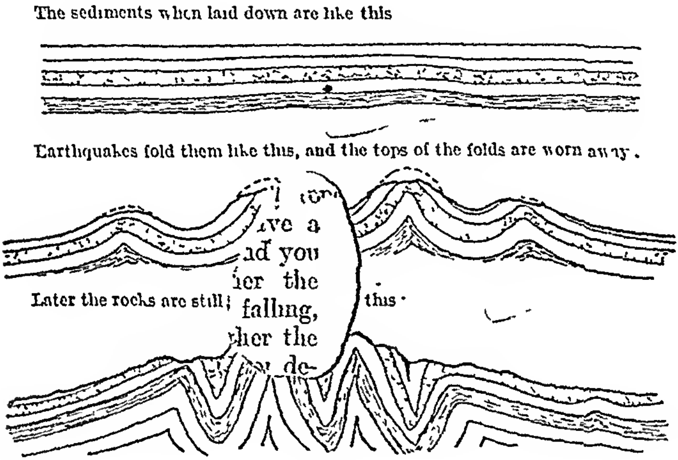
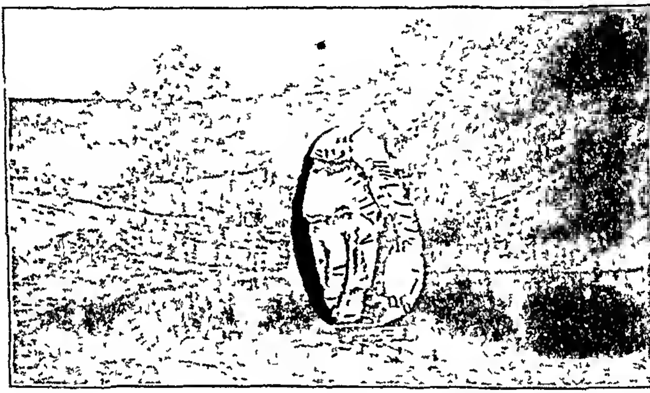


FIG 45.

earthquakes. Many, if not most, earthquakes are due to the movements deep down in the crust of the great masses of molten rock Sometimes the earthquakes raise big tracts of the earth's surface gradually upwards, others lower them so that the sea covers those areas that were once land In the great earthquake which destroyed the chief port and much of the capital of Japan in 1923, the sea floor around Japan rose as much as 1,500 feet as the result of the one earthquake. But when an earthquake or a series of earthquakes causes a mass of sediment to be

raised up above the level of the sea it nearly alw... the strata of those rocks, sometimes into gent... sometimes into sharper folds The simplest form... is an arch, or an anticline, and the opposite is a ho... a syncline We may get anticlines and synclines ti... packed together as you see in the diagram, but the important point to remember is that as soon as these folds are formed the agents of denudation the rain and the rivers, get to work and so we do not find that the surface of a single bed or stratum runs along the surface of the ground for



[Photo L D Stamp.

FIG 46.—Folded rocks (a syncline) in an old quarry.

any distance When we talk then about the slope or the dip in the strata of the earth's crust, we do not mean the same thing as the slope of the land. It is something quite different

When a part of the earth's surface has been highly folded we usually get formed as a result chains of mountains Nearly all the great mountains of the world are, as we say, folded chains, because they have been formed by the folding of layers of the earth's crust But there is another change which is caused by earthquakes Some of

der rocks naturally do not fold easily, but instead reak or crack We call these breaks or cracks in h's surface "faults" We cannot usually see them ks, because the two sides are easily forced together, ust that the rocks on one side of the crack move ward and on the other side of the crack move downwards Sometimes a big mass of the earth s crust is forced up between two cracks and we get a mountain which we call a block mountain. At other times a big mass of land slips down between two cracks and we then get formed what is called a rift valley The little diagram will help you to understand what is meant by block mountains and rift valleys Notice that what we have already said enables us to classify mountains into four groups fold mountains, formed by folding in the earth's crust, block

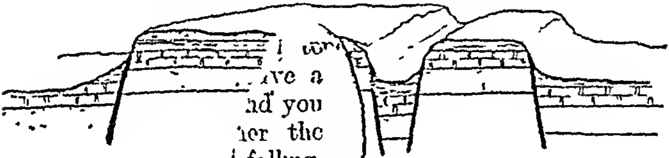


FIG 47 —Diagr ountains and rift valleys

mountains, between mountains of accumulation, such as volcanoes (when the material is thrown out of the earth s crust), and mountains of denudation (where the surrounding land has been worn away)

You may say we do not very often get earthquakes now, and we do not see great chains of mountains being formed That is because the present period in the earth's history is a comparatively quiet one. But there have been other periods in the earth's history when exactly the opposite has been the case. These are the great mountain-building periods. Nearly all the great mountain chains which we can trace on a globe or on a map of the world at the present day were built up at one and the same period. Even then there were only some parts of the earth's surface which were affected by the mountain-building movements. That

is why we usually find the great mountain chains, whereas there are other parts of the earth's surface which are scarcely folded at all. It is just the same with volcanoes. There seem to be lines of weakness running through the earth's crust, and along these we find great volcanoes. Look at the map of the world and notice how the volcanoes seem to follow certain quite definite lines.

Before we leave this section we ought to learn something about the useful substances which man gets from the earth's crust. In the first place there is water. When

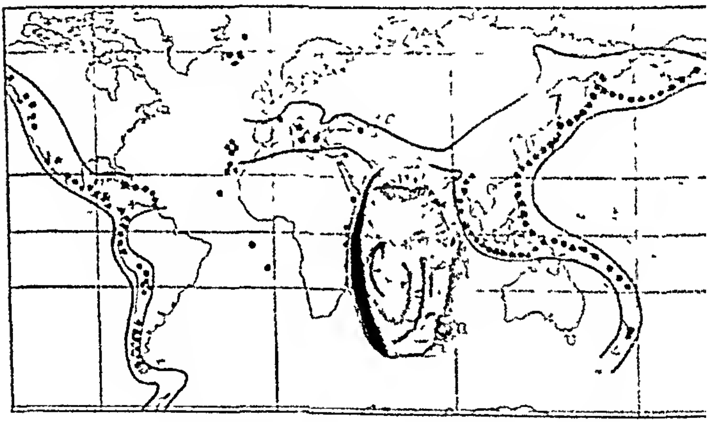


FIG. 18.—Map of the world to show lines of volcanoes.

rain falls on the surface of the ground some of it collects together and runs away as a stream, but some of it soaks into the ground. Now there are some rocks through which rainwater can pass (porous or pervious rocks), and there are other rocks through which it cannot pass (impervious rocks). You can imagine that it can very easily soak through a bed of sand, but if it gets to a bed of clay it will not soak through but will run along underground. It may run along under the ground until the bed of clay itself comes to the surface, and then we find that the rain-

…mes out again at the surface and forms what we …pring. Look at the diagram carefully and you …how certain types of spring are formed In some … the world the rocks underlying the earth's surface …t in the form of a basin, that is, are shaped rather like a saucer If the underlying rock is of clay or of other rock through which the water will not pass you can

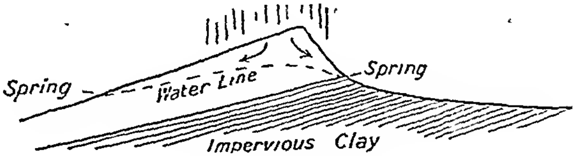


FIG 49 —A spring

see that rainwater will draw from the edges of the basin towards the centre of th… and a great quantity of water will there collect …ve a …ell is bored, as you see in the diagram, towards …d you … of this basin the water will very often gush o…er the …ting well We call such wells artesian wells falling, …ome parts of the earth's surface where artesian …her the …ery useful

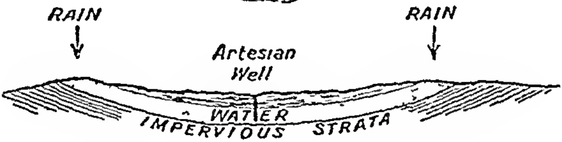


FIG 50 —Section showing an artesian basin

Then there is the very important mineral coal. We …ve already learnt how coal has been formed from the …mains of forests and is found between layers of sedimentary rock So coal occurs in seams which are just like the strata of the sedimentary rocks The seams of coal may be folded into anticlines and synclines and broken by faults, and that may make the mining difficult. Coal is

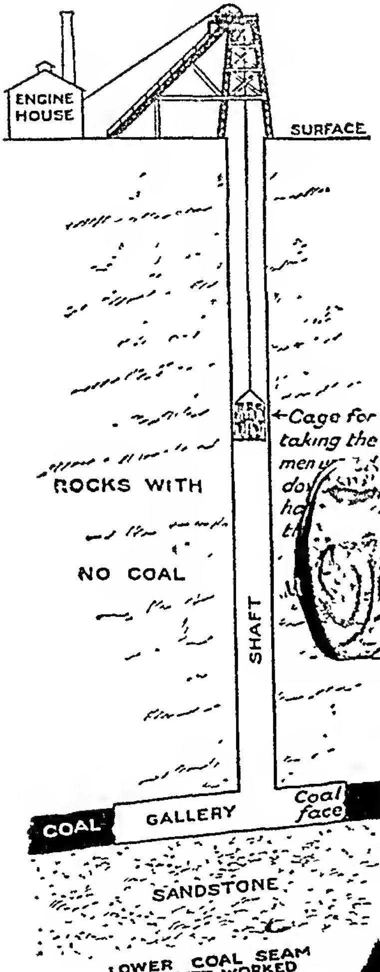


Fig. 51 —A coal mine.

usually mine digging a h shaft in the and working o coal seams from bottom of the sha You will see that coal always occurs amongst sedimentary rocks, never amongst metamorphic or igneous rocks, where it would have been destroyed by the heat

Another mineral is oil. This is a liquid, but it does not occur in the same way as water, because oil is lighter than water, and as there is usually water also in regions where oil occurs the oil always floats to the surface of the water, and so instead of being found in hollows or synclines of the rocks it is found underneath the arches. The little diagram shows this. A hole has to be bored or a well drilled and the oil may flow out of it, or can be got out by pumping

there are all the metallic ores and the precious Most of these have come up in molten condition cks from the interior of the earth, and so are found ons of igneous or metamorphic rocks usually occupy- narrow cracks or, as they are called, veins Sometimes the agents of denudation have washed the valuable metallic ores out of their veins, and we may find such things as gold or tin ore as stream deposits or even amongst sedimentary rocks. In such cases they are called alluvial deposits, because the fine mud which is deposited by rivers at the present day at their deltas, or on either side of their banks they overflow, is called um. There are some ores, ularly iron ore, which may nd either in sedimentary

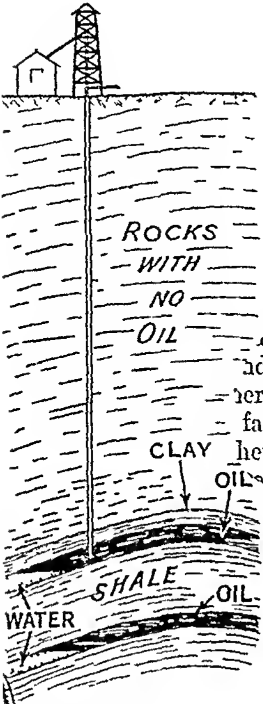


FIG 52 —Diagram of an oil well

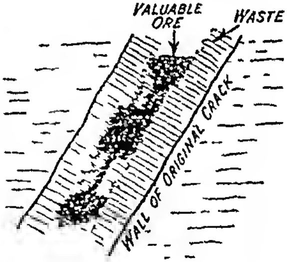


FIG. 53 —A vein.

rocks in thick beds, almost like coal seams, or may be found as masses amongst igneous rocks Iron ores are thus found in many parts of the earth's surface But notice that it would be very silly to look for coal or oil in regions where the rocks are mainly volcanic, and it would

not be of very much use to look for many of th minerals in regions where there are young soft sed rocks

SECTION V

WATCHING THE WEATH

How often we talk to one another about the weather ! Often we say, "Isn t it hot to-day ? " or "Isn t it cold to-day ? " Sometimes we say, "Oh, bother, it's raining," or perhaps, "How windy it is to-day ! " Sometimes we talk about the air being "heavy " or "oppressive " You see that in talking to one er we pick out a feature of the weather which hap trike us most. In order to study the weather com have to study a number of different things The se are

(a) Heat and cold, or t
(b) The moisture in the
(c) The pressure of the
(d) The movement, or wind, which results from differences in pressure.
(e) Rainfall

Let us now look at each of these things in turn, but before we do that we must learn something about the air itself Although we cannot see it, we know that we are surrounded by air, and we can feel this air when it moves as wind and blows against our faces If there were no air we should not be able to breathe or live We can prove this a putting a small animal under a glass has to an instrument called an air pump, which a well drilled If the air is pumped out the animal die may flow although we cannot see it, consists of a or can be and amongst other things the air has pumping one-fifth of the air or atmosphere consists

end to its oxygen This is the most important part of erent because it is the part which we breathe and which (1) Co e in order to live. If there were no oxygen in we should not be able to live, but oxygen by s rather strong and would be dangerous for us, so he other four-fifths of the atmosphere consist very rgely of a gas called nitrogen Nitrogen is like the water re mix with strong lemon squash or lime juice, and is nixed with oxygen to make the oxygen less strong There re small quantities of various other gases in the atmosphere, but we need not worry about these except two of hem. There is one called carbonic acid gas or carbon ioxide When we breathe oxygen into our lungs, as you now, we breathe it out again But when it is breathed ut again part of it has been changed and has become arbon dioxide. Now carbon dioxide is really a poison o animals and human bei ur n large quantities, and so you have a small roor ive a people all breathing out his gas, after a short ti d you nosphere becomes stuffy nd the people begin ier the py or perhaps begin to et headaches, and if t falling, ll left in the room without any more fresh air her the d eventually die for lack f oxygen and because r de- d been poisoned by the arbon dioxide That is why we must always have fresh ir in our rooms in order to keep healthy But the carbon ioxide in the air has another use. It is taken in by lants and trees through little tiny mouths, or stomata, which they have in their leaves It is used by the plant or building up leaves and roots, and the plants breathe the oxygen from their stomata since they require only ttle of it That is why it is a good thing to have a plants in a living-room during the day, for they help . But at night the plants cease to give rocks in thick . But because of the work they do in found as masses healthy to live in a place where there thus found in es:

notice that it portant gas in the atmosphere is water regions where ture. You all know what happens if you

put a saucer of water out in the sun, or what hap[illegible] a puddle of water in the road when the sun co[illegible] Quite quickly it disappears. Where has it gone [illegible] has gone into the air The water has been chang[illegible] water vapour, which we cannot see and which has p[illegible] into the air It is important to remember, however, that the air can only hold a certain proportion of water vapour. After a time it gets as much water vapour as it can possibly hold, and we then say that the air is saturated with water vapour or moisture Now let us look at the things we have to do in order to study the weather

(*a*) *Heat or Temperature* —We measure the heat of the atmosphere by an instrument called a thermometer. There are different kinds of thermometers The common one consists of a narrow glass tube with a bulb at the end and clos[illegible] the other end. The bulb and part [illegible] stem are filled with a very heav[illegible] called mercury Now mercury, [illegible]g things when it is heated g[illegible] and mercury gets larger ver[illegible] much more quickly than the g[illegible] which it is surrounded So if you breathe on the mercury in the bulb and make it warm the mercury expands and you see the little column shoot up in the stem quite rapidly. All we have to do then is to mark on the stem or on the piece of wood on which it is mounted a number of divisions which wi[illegible] tell us the amount of heat or cold. W[illegible] find that the temperature of freezing wat[illegible] or rather of melting ice, is always t[illegible] same, and we call this freezing-point W[illegible] find, too, that the temperature at sea level of fresh water which is boiling, that is, of boiling water, is always the same And so we have two fixed points on our thermometer. In our English thermometers we call

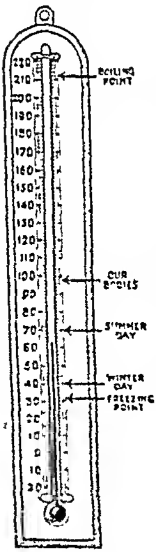


FIG. 51.—Thermometer

point 32 degrees (written 32° F), and boiling-2 degrees (212° F), so that there are 180 little or degrees between these two points On the heit scale, as it is called, there are certain other ful figures to remember There is the temperature of our body, which is just about 98° when we are healthy and which rises to over 100° when we are ill. We shall learn later much more about different temperatures, but it might be useful to remember that a warm room, about as warm as on a summer's day, is between 60° and 70°.

Besides the simple thermometer which most of us have seen there is a special kind, or sometimes two separate

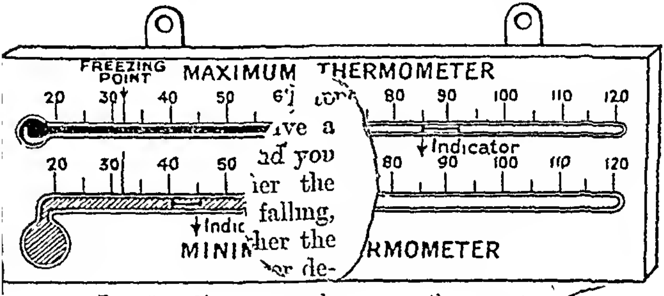


FIG 55 —Maximum and minimum thermometers

ones, called a maximum and a minimum thermometer. Inside the tube of the maximum thermometer there is a little piece of metal or glass which is pushed up and up as the temperature rises, but which stays at the highest point hen the temperature drops. This thermometer therefore ows the highest temperature which has been reached ing the day. In the minimum thermometer the little dicator is arranged to show the lowest temperature eached during the day. If the thermometers are therefore ooked at once a day we can put down on a piece of paper or record in a book the highest and lowest temperatures reached during that particular day. We then shake the thermometers and put the little indicators so that the

thermometers are all ready to record for the n[illegible]. The difference between the highest and lowest [illegible] tures reached during the day is called the dai[illegible]. In some places, especially on high mountains or in [illegible] a long way from the sea, the nights are very cold an[illegible] days are very hot Such places are said to have a great daily range of temperature If we take the average between the maximum and minimum temperatures we get the mean temperature for the day, then when the temperature has been recorded in our books for every day of the month we can find out the monthly average temperature. Some years are hotter than others, so it is much better if our observations are spread out over a number of years. The little table given here shows you how such an average is calculated.

Place	Year	Average January temperature
A	19[illegible]	46.2°
	19[illegible]	44.8°
	192[illegible]	45.1°
	1924	45.7°
	1925	46.8°
	1926	46.4°
	1927	44.8°
		7)319.8
		45.6° average

These average monthly temperatures are very imp[illegible] in geography In most parts of the world the great[illegible] difference is between the months of January and J[illegible]. In the Southern Hemisphere the hottest month is usu[illegible] January, and in the Northern Hemisphere it is usua[illegible] July, and again in the Southern Hemisphere the colde[illegible] month, or the typical winter month, is usually July, whilst in the Northern Hemisphere it is January If we take the temperature of the hottest month and the temperature of the coldest month the difference between them gives us

nal range of temperature. Some places have only small difference between winter and summer tem- s, perhaps only 5° or 6°, and these places are have an *oceanic* or *insular* climate, because they enerally places that are near the oceans, for example, islands (Latin *insula* = an island) We shall learn the reason for this presently Other places, especially those which are a long way away from the sea, such as in the interior of the great continents have a very great difference between their very cold winters and their hot summers There are even places where the annual range is as much as 100°. Such places are said to have a continental climate. Notice that we have been talking all the time about the temperature of the air and this temperature is usually measured in the shade, that is, away from the sun, about five feet from the ground

We must now learn h air obtains its heat The source of nearly all the the sun. You can tell this at once on a summer's you stand in the sun you quickly get very hot to the shade to get cool As the sun's rays pa air they warm it very slightly, but the gre f the heat goes towards warming the ground be the surface of the sea on which the sun's rays strike. Then the air which is near the ground or near the water becomes warm because it is closely in contact It is because the air gets most of its heat from the surface of the ground in this way that it becomes steadily colder as we go upwards, although we are actually going nearer the sun. Thus it is very cold indeed on the tops of high mountains, so cold that there nearly always snow there. You can really think of the as a pile of blankets that are keeping the earth warm. man living at sea-level has the whole thickness of the air above him to keep him warm, just as a man who is under a pile of blankets But when that same man climbs a high mountain he has much less air above him to keep him warm, it is just as if he had climbed above most of his blankets and only had a few above him to keep him warm

Where the blanket of air is thin the warmth is [illegible] lost Thus we find that for every 300 feet w[illegible] climb up, the temperature drops on an average 1° [illegible] a place 3,000 feet above the level of the sea will [illegible] temperature 10° lower than if it were on the plain. [illegible] pose we were at the top of Cader Idris, one of the highest mountains in Wales, nearly 3,000 feet above sea-level, and we looked at a thermometer and found that the temperature was 41° If that spot were at sea-level the tem-

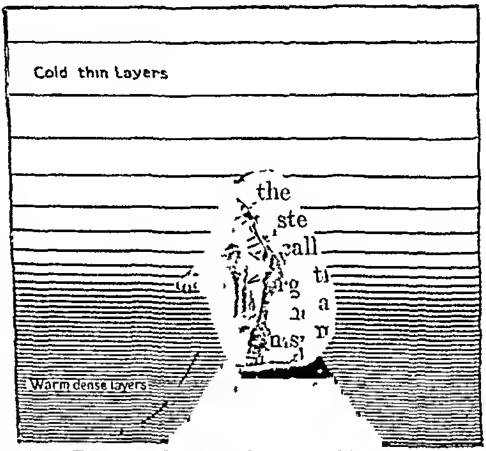


FIG 56 —Diagram showing why it is colder near the tops of mountains

perature would be $\frac{3000}{300} = 10°$ higher, so that we [illegible] that the sea-level equivalent of the temperature at the [illegible] of Cader Idris is 41 + 10 = 51°. We call this reduc[illegible] the temperature to the sea-level equivalent.

There is a word that you ought to know and that wo[illegible] is isotherm. The part *iso* means equal, and if you [illegible] a word commencing with *iso* you will know that it means something to do with equal. Isotherm means equal as regards heat, or equal temperatures, and an isotherm is

e...id to ...inary line drawn to pass through all places having ...erent ...e temperature at the same time, and in drawing ...1) Co... ...s we usually reduce all the temperatures to sea

...y and remember if you have ever on a hot summer day sat down on a stone and then found that it was so hot that you had to jump up quickly If on the same day you had put your hand into a pool of water you would have found that the water was fairly cool, that is, because the land—or earth or stones—gets hot quite quickly when the sun is shining, but during the night loses its heat quickly also. Water, on the other hand takes much longer to get hot but longer to get cold We shall find that this is very important ... ... Why should w... ...ve a trouble to learn ...ad you about the temperat...her the of the atmosphere? ...I falling, one thing it is import...her the for the farmer ...r de-wants to know whether there is going to be frost, because if he plants his crops too soon the frost may destroy them. In studying temperature we know the crops it will be possible to grow in a country. ...t depends, too, on the temperature from day to day and ...om month to month what clothes we wear, whether we ...ght a fire in our houses, and so on. We find when we ...ome to look at the world as a whole that we can divide ...he earth's surface into a number of zones The hottest part of the earth, that is, hottest all the year round, is near the equator. You have already learnt where the Tropics of Cancer and Capricorn are, and between them, across the equator is what we call the Torrid or Tropical

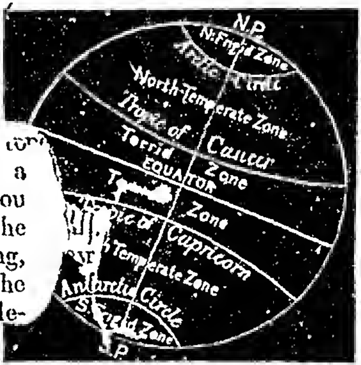


FIG. 37 —Diagram showing the heat zones of the world

Zone, then on either side come the two Temperat[illegible] the North Temperate Zone and the South T[illegible] Zone, then inside the Arctic Circle and the [illegible] are the Frigid Zones, the North Frigid and the [illegible] Frigid

(*b*) *The Moisture of the Atmosphere.*—We have already learnt that there is in the atmosphere a quantity of water which has become invisible and forms water vapour It is not difficult to see how that water vapour got there You know what happens after a storm of rain when the sun comes out The puddles of rainwater on the ground or by the side of the road quickly dry up, as we say, because the water is turned into water vapour and passes into the atmosphere We say, therefore, that the water vapour is obtained by evaporation of water on the earth's surface. Heat is the great cause of evaporation, and therefore evaporation [illegible]atest near the equator Water vapour is only about [illegible] heavy as air, and so it is rapidly spread by the [illegible]en it is very hot you know that you ge[illegible] can go on drinking and drinking, but [illegible]me when you know that you have had en[illegible]t the same with the air. Hot air is very th[illegible] drink up large quantities of water vap[illegible] but there comes a time when the air cannot take up any more The air is then said to be saturated. But cool air or cold air cannot take up nearly as much water as hot air, and so cold air is very quickly saturated We measure the exact temperature of the air with a thermometer, and we must also have a means of measuring the dampness of the air We do not use the word dampness We talk about relative humidity. When the air is saturated, that is, it has all the water vapour it can hold, its relative humidity is said to be 100 When it is absolutely dry its relative humidity is said to be 0 When the air is half saturated, then its relative humidity is 50, and so on We have to talk about *relative* humidity because if we change the temperature of the air, that at once makes a difference, for if we warm the air it can

and to [illegible]tely take up more water vapour You can see [illegible]erent [illegible]hat will happen if you take very damp air, or [illegible]) Co[illegible]d air, and cool it slightly; it will not be able to [illegible] much water vapour, and some of the water vapour [illegible] be turned into liquid water That is how we get the formation of clouds and rain. Try this for yourself Your breath is warm and contains quite a lot of water vapour. If you breathe out against a cold surface, such as a window pane or a plate, immediately some of the water vapour in your breath will be turned into water and you will see little drops forming on the glass or the plate. The clouds that we see in the sky are formed in very much the same way. The warm, moist air rises from the surface of the earth because the water vapour is so light and as it rises it cools, because you know it is not nearly so warm in the upper part of the air. Little tiny drops of water are formed and [illegible]ear to us as clouds, the little drops collect together [illegible]ve a [illegible]er drops which may fall as rain Sometimes th[illegible] you [illegible]aporate again before they reach the surface of [illegible] the [illegible]nd so we may have clouds but no rain. When falling, [illegible]air is very cold tiny pieces of ice may be form[illegible] the [illegible] of water, and fall to the ground as hailstones [illegible] de- [illegible]l colder regions the water condenses as so many tiny crystals of ice which we call snow. At night time we have learnt that the surface of the earth loses its heat very quickly, and so the surface of the earth becomes cold and the air close to the earth is not able to hold as much water vapour, so some of the water vapour is left on the surface of the earth in the form of dew. The water is really left in exactly the same way as the water from your hot breath which you breathed against the cold surface of the plate. In cold countries the surface of the earth at night may become colder than freezing-point, and so the deposit is frozen and we call it hoar frost More dew or hoar frost is usually found on clear nights than on cloudy nights, for clouds prevent [illegible]e surface of the earth from cooling so rapidly. When water vapour is condensed but remains suspended in

the air near the surface of the earth like a cloud [illegible] a mist or a fog

(c) *The Pressure of the Atmosphere*—Have y[illegible] been out doors when a strong wind is blowing? [illegible] times we say that the wind is so strong that it nearly b[illegible] us over and it can sometimes do great damage. You see from this that air in motion can exert pressure, and although we do not really feel it, the air is pressing down on us all the time whether it is moving or not. Wherever you may be when you read this, you will have pressing down upon you a column of air about 200 miles high. Although you do not feel it this column of air is exerting a pressure equal to 15 lbs on every square inch of your body, both inside and outside. You know that a motor tyre or a bicycle tyre does not burst when it is made to stand a great pressure of air inside. In the same way your body is made to withstand this press[illegible] and you do not notice it. But if you climb high moun[illegible]st[illegible]here the air is thin you will find it very difficult to[illegible]breathe. No one has ever yet climbed to the to[illegible] Everest, the highest mountain in the world, bec[illegible] the great difficulties in climbing to such great [illegible]o get enough air to breathe. We have already [illegible]red the atmosphere to a pile of blankets keeping the earth warm. You will see also that at the bottom of the pile of blankets there will be the whole weight of all of them, and so the weight of atmosphere or pressure of the air is greatest at sea level. As we climb upwards it steadily becomes less. Now we must have an instrument for measuring this pressure of the atmosphere. The instrument we use is called a barometer, because the Greek word "baros" means "weight", so the barometer is really a measure of heaviness.

If a glass tube about three feet in length be closed at one end, filled with the very heavy liquid mercury, and inverted with its open end in a cup containing the same substance, the mercury will fall in the tube until its level is about thirty inches above the level of the mercury in

This is because the weight of a column of the heavy mercury is equal to and balances the weight of a column of air 200 miles high. Now, as the pressure of the air varies, so the height of the column of mercury varies. When we talk about a pressure of 30 inches or of 29·5 inches, we mean that the pressure of the air will balance a column of mercury of that height. On a mountain 15,000 feet high—like Mont Blanc in Europe—the pressure is only about 15 inches. But even at sea level the pressure of the atmosphere is not the same in all places and in any one place it varies from day to day. Perhaps you have a barometer at home and you tap it to see whether the mercury is rising or falling, that is to say, whether the pressure is increasing or decreasing. There are several reasons for variation in pressure. Hot air is lighter than cold air, so when air is heated it begins to rise and so the pressure becomes less, so when the temperature is high the pressure is often low. We have already learnt that water vapour is lighter than air. When air has much water vapour in it, it is usually lighter, and thus the pressure is less in rainy weather when the air is damp. Then when we look at the earth as a whole we find that there are certain belts on the earth's surface where the pressure is usually lower than elsewhere. There is a belt of low pressure running round the equator, for

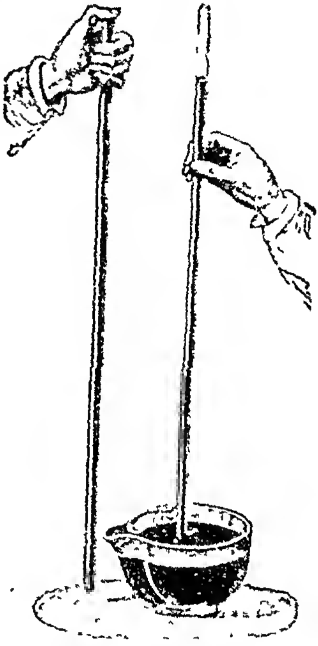


FIG. 58.—Diagram of a barometer

there it is hot and there is great evaporation, so [illegible] w
is nearly always moist Thus there is a hot, m[illegible] old
of low pressure You have learnt that land loses [illegible] wa
much more quickly than water. And so in the [illegible] ow
the interiors of the great continents and land mas[illegible] become very cold indeed, and naturally the air over these land masses is also very cold. And so in the winter we find great masses of cold heavy air over the continents of Asia and North America In the summer these same land masses become very warm and the air over them warm also, because warm air is light the pressure over the land masses in the summer is also much less We shall see presently what happens as the result of this

(*d*) *Wind* —Wind is the air in motion and winds are caused by differences in pressure The wind always moves from places of high pressure to places of low pressure In this country we can never be quite sure from what direction the wind will be blowing to-morrow or the next day (notice that we always name a wind after the direction *from* which it blows, so that the south-west wind is a wind blowing from the south-west) But there are other parts of the world where the winds blow very regularly, almost throughout the year, from one direction, indeed, we may say there are three classes of winds—(1) the regular winds; (2) the periodic winds, which in some places blow for definite periods, and (3) local winds, or irregular winds

Regular Winds —Let us take first the regular wind systems of the globe You have already learnt that round the equator there is a belt of low pressure and great heat. Naturally the winds blow towards this low pressure b[illegible] In the Northern Hemisphere, owing to the movement [illegible] the earth, we find the winds blowing from the north-[illegible] and in the Southern Hemisphere from the south-east and so we have what are called the Trade Winds, the North-east Trade Winds and the South-east Trade Winds. These winds are usually very regular and constant, especially over the sea, but you must notice that the position of the winds changes slightly. During our hot

… at is, in June and July, when the sun is shining over the Tropic of Cancer, that is, north of the … the low pressure belt of the equatorial region is …orth of its average position, and so at this season … year the Trade Winds are blowing farther north than is the case at other seasons; similarly in our winter in December and the months near, then these winds are south of their average position. The Trade Winds thus blow mainly within the Tropics and are especially noteworthy over the sea and on lands adjoining the sea. Notice

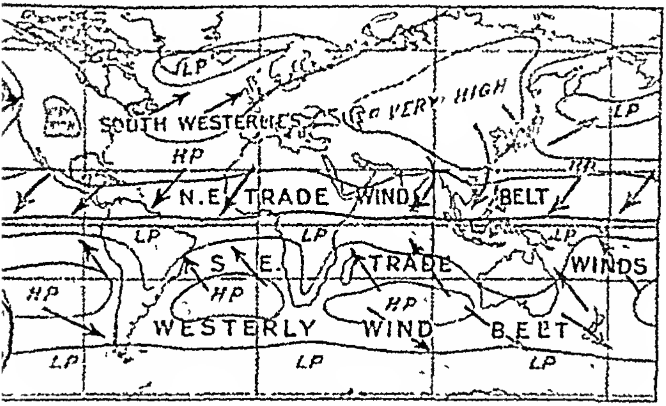


Fig. 59.—The regular wind belts of the world (in January).

that they blow in each case from the east, so that they are felt on those lands which are on the eastern side of the …eat continents in equatorial regions—along the east …sts of America and of Africa, Asia and Australia.

…hen in the Temperate Zones the winds blow not nearly …regularly but usually from the west, and we call these …inds therefore the "Westerlies." In the Northern Hemisphere we have the south-west winds, or South-west Antitrades as they are sometimes called. In the Southern Hemisphere they blow from the north-west. Notice from a map of the world, or from the globe, that in the South

Temperate Zone there is a tremendous amo side and so over this sea we find the winds bl way regularly, but in the Northern Hemisphere are land masses and so the south-westerly winds less regular The British Isles really lie within the of these winds, and so our most important winds do blow from the south-west

Periodical Winds—Of periodical winds there are some which blow just for twelve hours and are found in places

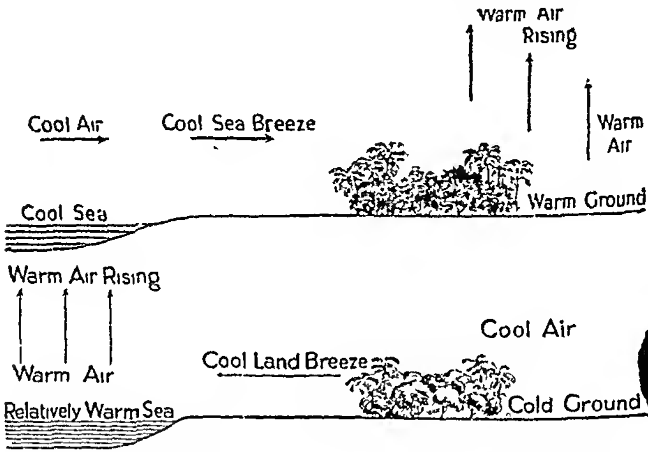


FIG 60—Diagram showing the course of a cool sea breeze by day (upper diagram) and a land breeze by night (lower diagram).

near the sea We call these winds land and sea breezes For during the day the land becomes heated up quickly than the sea The air over the land is heated too and becomes light and rises. A cool sea blows in from the sea because this is the cool air bl in to take the place of the warm air which has risen ov the land. Many places on the sea coast would be hot indeed if it were not for this cooling breeze from the sea But during the night the land cools more rapidly than the sea, and for some hours after sunset the air over

...s colder than over the sea; with the result that heavy air from the land flows out to the sea as a ...ze.

...ons.—If you could imagine a great mass of land, ...as a continent, becoming greatly heated during the summer, you will see that the air over it will become hot and will rise and that cooler air is likely to blow in from the ocean to take its place This is really the same as a sea breeze which we have just explained, except that instead of blowing for twelve hours the cool wind from

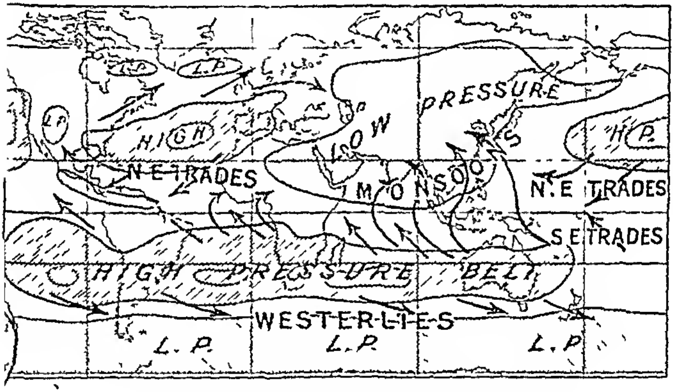


FIG. 61.—The regular wind belts of the world (in July)

the ocean blows for the hot half of the year, possibly for six months. Such a wind is called a monsoon In the ...nter the continental mass becomes very cold, and so ...cold, heavy air over it blows outwards to the sea, ...there are outblowing cold winds at this season The ...gest land mass in the world is Asia and the monsoon ...nds are most important round the continent of Asia, especially in the south-east and east Now you have learnt about the pressure belts and the wind systems of the world, try and study Fig 61.

Of the *local winds* the most important are those which

are associated with cyclones or depressions ... cyclones You have all listened to the wea ... which is given out every day over the wireless, ... must have heard the announcer say at some time ... "There is a depression over the north Atlantic wh... approaching the British Isles, moving slowly eastwards." In all parts of the world, but especially in temperate regions, there are local areas of high pressure surrounded by regions of low pressure, or small regions of low pressure in a belt of high pressure Naturally the winds blow towards the centre of a low pressure system or depression: but at the same time they blow round this centre owing to the movement of the earth in an anti-clockwise direction, that is opposite to the direction followed by the hands of a watch An anti-cyclone usually, in this country, brings us fine weather, sometimes cold and still and foggy weather in winter, the winds blow round and away from the centre in the same direction as the hands of a watch, that is, in a clockwise direction You can look upon these little eddies and whirls in the main current of the air, especially in the belt of the westerly winds, as being like the eddies or the whirls that you see in a stream or a river which is in gener... flowing on its way towards the sea In this count... cyclones or depressions with inblowing winds usually brin... wet, stormy weather, cold in summer, but may be mild and muggy in winter.

(e) *Rainfall*—We have already learnt how the air becomes saturated, and when saturated air, or moisture-laden air, is cooled condensation takes place, and so we get rainfall, or if it is cold, snowfall We can use the w... precipitation to cover both rainfall and snowfall. ... air obtains its moisture by evaporation from the surf... of large areas of water such as the ocean. Air which ... come from land regions is usually dry.

There are several ways in which moisture-laden air ca... be cooled to give up its moisture as rainfall. It may be cooled by rising upwards into the upper and colder regions of the atmosphere, or it may be cooled by being blown as

...ld to colder regions. Actually, we can distinguish four ...erent kinds of rainfall

(1) *Convectional Rain.*—In very hot regions, such as near

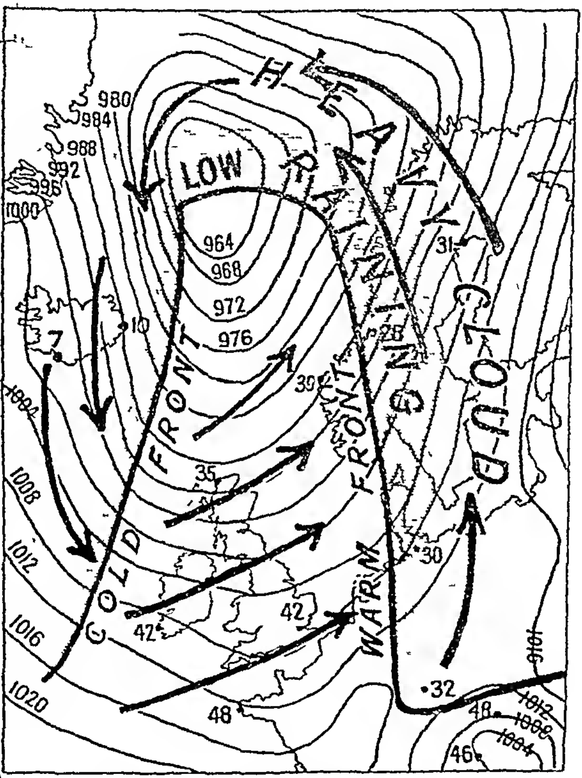


Fig. 62.—A cyclone over the British Isles

fine lines are lines of equal pressure, the figures, such as 32, etc., are temperatures, the arrows show wind.

he equator, evaporation is very great, and the moisture o formed is lighter than dry air and so it readily rises t soon expands, cools, and rain falls, and thus the rain alls on exactly the same area, or nearly the same area, from

which the moisture was derived. This type of rain occurs almost every day in countries near the equator and explains the very heavy rainfall to be found all the year round in the equatorial belt

(2) *Relief Rain* —When wind blowing from the ocean and so laden with moisture reaches a land mass, the wind, if there are mountains or hilly areas, is forced to rise, and in rising it becomes cooled and rain results. We see that such rain is closely associated with the physical features, or relief of the land, and so we call these relief rains.

(3) *Cyclonic Rains* —We have already learnt that in a cyclone or depression the winds blow towards the centre and in the same time round it in an anti-clockwise direction. In the centre there is a low pressure area with ascending

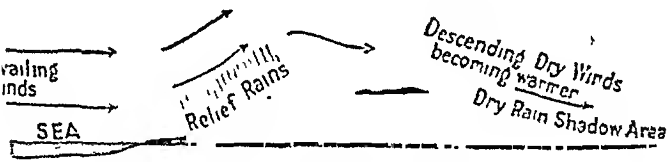


FIG. 63 —Rain shadow area.

air currents If the air here is moisture-laden it will rise and will be cooled and rain will fall. Such are the rains we get so frequently in this country, which are associated with these depressions and so are called cyclonic rains.

(4) *Thunderstorm Rain* —Then there is the rain which we get from very sharp local storms such as thunderstorms.

When a moisture-laden wind is forced to rise over a mountain range it must be cooled and is sure to lose some of its moisture The higher the mountains, the more moisture is lost When the wind has finally passed over the range it is almost a dry wind , further, when the wind drops to the lower ground it is warmed rather than cooled, so it becomes a thirsty wind and not one which is ready to shed any of its moisture. That side of a mountain

hich faces the rain-bearing wind and receives the call the windward side, the dry side we call the or leeward side. The land which is kept dry in by a mountain range is said to be in the "rain of the mountains The rains which fall on the lee are mainly convectional or cyclonic rains The east coa Scotland is in the rain shadow of the Highlands; plain of York and the East Riding are in the rain sh of the Pennines On the rainy west side of Englan the Lake District the rainfall is over 100 inches, on the east coast in Essex it is less than twenty-five. Simila a large part of the plateau of Ind is in the rain shadow of the West Ghats, and so receives very little ain

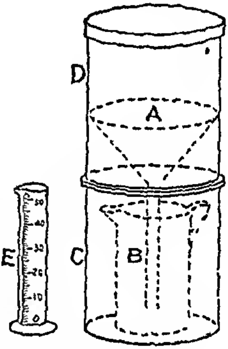


FIG 64 —Picture of a rain gauge

Rainfall is measured by means of a rain-gauge All the rain which falls over a certain area passes into a funnel and is collected into a jar where it cannot evaporate, and where it can be measured When we say that the rainfall for one day has been 2 inches, we mean that if all the rain which fell that day had remained where it fell, it would have formed a layer 2 inches deep. In nature, as you know, as soon as the rain falls, some of it sinks into the ground, some of it evaporates, and some runs into the streams and rivers. That is why we use a rain-gauge to measure the al quantity which fell. Just as in recording temperature took the readings every day, so we do with the -gauge We note the amount which falls every day, d then by *adding* up the amounts for each day we get e monthly amounts. The most important figures are the *monthly averages*.

Rainfall Maps.—On a map of any country we can mark the monthly or yearly averages. Sometimes it is better

to use the amount for a season. such as the rain; Fig 65 is a map of the world, which shows you the ... for the months of June to August, when we have ... in England On any rainfall map we can ... through places having the same rainfall; these ... called "isohyets" You must remember that the ... changes gradually You cannot have one ... rainfall of more than 80 inches, and the next ... than 40 There must be an area between, ... only a narrow strip, having a rainfall from 40 ...

Remembering Rainfall —You cannot rememb... figures for rainfall, it is too difficult

Try to note.

(*a*) The time of year when most rain falls

(*b*) Whether the rainfall is good, moderate, p... very poor In the tropics above 80 inches is g... much higher it may be excessive), 40 to 80 moderate, 15 to 40 poor, and below 15 very poor. In temperate regions both evaporation and rainfall are less. Above *40 inches is good, 15 to 40 moderate, 5 to 15 poor, below* 5 very poor. It is largely owing to differences in evaporation that a winter rainfall of 6 inches in the temperat... areas of Australia is of more value than a summer rainf... of 12 inches in the Australian tropics

Weather

We have now learnt quite a lot about the atmosphere We have learnt about pressure and its measurement, about temperature, winds, moisture, rainfall, etc If we th... of any one day, all these things put together make ... we call the Weather Sometimes one seems more ... than the other and we can say it is wet weather to-... or perhaps it is very cold weather, or cloudy weat... We can talk, too, about the weather for the week or ... month. Sometimes for a whole week we may have ... stormy weather In tropical regions such as India the weather does not change very quickly. In the middle

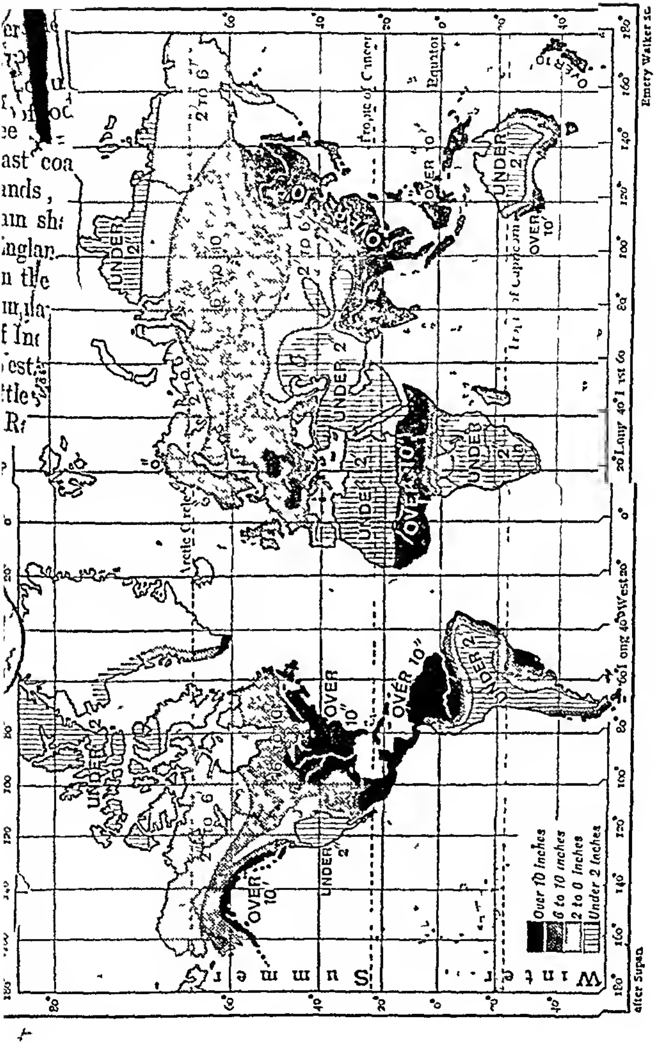


Fig 65 —Rainfall map of the world (Northern Summer).

of the dry season there may be a wet period, but not v often In other countries, including the British I every day may be quite different In our own to village one day may be wet and cold, and next day cl less, sunny and quite hot. In such countries everyb is very interested in the weather, and many of the s-papers publish every day little maps (called weather charts) showing the state of the weather. On the oceans sailors have to watch the weather for storms, and it is important to farmers in all parts of the world.

Climate

Climate is the average of the weather. We must be quite sure we understand what that means, because climate is one of the most important subjects in geography In England we have summer and winter, but rain falls at all seasons of the year At the same time, the summers are never very hot nor the winters very cold. Countries round the Mediterranean Sea have quite a different type of climate In the case of this type of climate we can divide the year into a short, mild, moist winter, and a long, hot, dry summer. Every year there are these seasons In some years the rain during the winter or rainy season is very abundant; in other years not nearly so much rain falls But that does not make any difference to the truth of the statement that each year has its wet winter and dry summer. Sometimes we may have a hot day in the midst of the winter, and we can say that the weather for that day is exceptional. But one exceptional day does not alter climate, because the climate refers to the normal or usual condition of the weather If we observe every year carefully for many years the amount of rain which falls during any particular month, or during the rainy season, we can get the *average rainfall*; in the same way we can find the average temperature, pressure, humidity, wind direction, etc All these averages—for a month, for a season, or for the year

becomes warm, and so it gives a warm current of air. Perhaps the most famous and most important of all the ocean currents is the Gulf Stream and its continuation, sometimes called the North Atlantic Drift This stretch of warm water comes across the North Atlantic Ocean from the south-west and passes by the British Isles, and on past the coast of Norway. It is largely as the result of the warm air from over this drift of water that our climate in the British Isles is comparatively mild On the other side of the Atlantic Ocean in the same latitude is the coast of Labrador and Newfoundland, which is bathed by a cold current, the Arctic Current So great is the difference as a result that the seas along the coasts of Labrador and Newfoundland are frozen every year. The sea is entirely blocked by ice, whereas ice never forms in the sea round the British Isles. Cold currents, such as the Arctic Current, often bring numerous icebergs, which may be very dangerous to ships Where cold and warm currents meet great fogs are often caused by the mixing of the cold and warm air over the two currents, whilst in other places where cold and warm currents meet the mixing of the air causes violent storms Study the maps very carefully and notice the principal currents of the oceans of the world Mark against each one whether it is a hot current or a cold current, and study the maps in your atlas which show you where the sea is frozen over in winter, and you will see how very largely this is caused by the influence of ocean currents

SECTION VI

THE REGIONS OF THE WORLD

We now know something of the great geographical factors, and, as we learnt in the first section of this book, these geographical factors make their influence felt on the

type of tree or grass which will grow and on [illegible] which can be grown by man and also on the wil[illegible] which can exist or on the tame animals whi[illegible] kept by man You do not find camels or gira[illegible] fruit orchards or the fields of this country, and [illegible] be very surprised if we found a crowd of monke[illegible] walking through one of our English woods. B[illegible] were walking through forests in India we should [illegible] unless we were unlucky, to see some monkeys playing there Again, we often see sheep in this country, but we do not see sheep feeding on the forest trees because they cannot climb the trees to get the leaves Instead we find the sheep feeding on the hillsides, where they can nibble the short grass So each type of vegetation has its characteristic animals, and when the natural vegetation has been cleared away by man there are certain crops, and certain crops only, which will grow, and there are certain animals, and certain animals only, which can be kept. If we study t[illegible] world we find that we can divide it into a number of great regions. These regions are determined mainly by the type of climate which is found. We have learnt something about climate and we will now study each of these great regions in detail

The Regions of the Hot Wet Forests

We have learnt that round the equator there is a belt where the temperature is high throughout the year, where the air is always damp, and where there is abundant rainfall Days and nights are both hot and so there is very little daily range of temperature. There is no summer and no winter, for it is hot throughout the year and there is indeed practically no difference between the hottest months and the coldest months The air is nearly always moist and it feels steamy, just like being, as we say, in a hot-house. There are many parts of the world where it gets hotter than it does in these regions near the equator, but there are no other regions where it keeps so equally

becomes ·es. There are the climbers which climb up and perhaps their sunlight by being dependent upon their bigger ocean cur nger brothers Often the climbers are so heavy and sometimes g that they will kill the tree by which they climb. if warm e twisted coils of their stems lie scattered about from the ound and make it difficult to walk through the on past There are other plants such as ferns and orchids, of the w get their share of the sunlight by growing on the

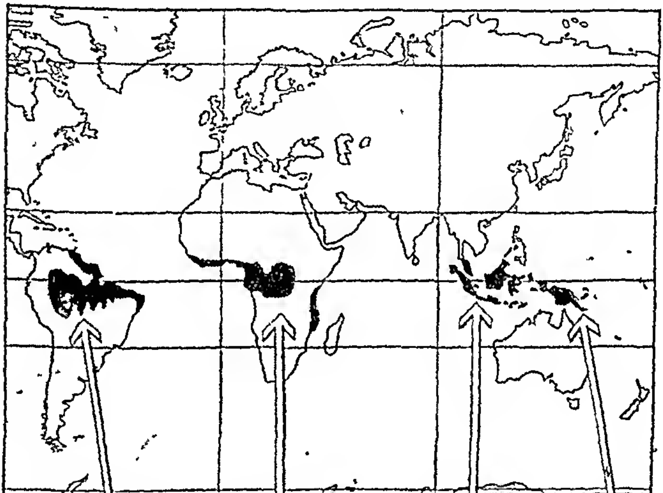


FIG 68 —Map of the world showing the equatorial regions

branches of the bigger trees. So in the hot wet forests we find three types of vegetation, namely (1) the big trees, (2) the climbers. and (3) the epiphytes, as we call them, which live on the branches of the larger trees The carpente dull and gloomy inside the forest that very kinds of trees ll live there. If we want to see the real particular kind we t imagine ourselves as belonging to a the forest and pick monkeys and make our way to the so far overhead that shall find many animals and other

creatures which have been specially fitted by nature to live in the tree tops There are our friends the monkeys who can jump very easily from bough to bough and very rarely lose their foothold There may be flesh-eating animals belonging to the cat tribe who move stealthily along the branches and try to catch the nimble monkeys If we could penetrate these great forests we should have to go carefully for there are poisonous snakes lurking among the branches We might be surprised to see some creatures which we never suspected could climb trees; for example, we should see some frogs, with curious suckers on their feet which enable them to move without falling off Then sitting amongst the higher branches there would be gaily coloured birds, parrots and parakeets, and a whole host of others, as well as a wealth of insects getting the honey from the gaily coloured flowers of the climbers In these great equatorial forests we might look for miles across a sea of green leaves without any break in it at all.

Now where do we find such forests growing in the world? The hot wet forests and the equatorial type of climate, as it is called, are found as a broad belt on either side of the equator stretching strictly (except where there are mountains and plateaus) from about 5° North to 5° South, but gradually fading away on either side so that some forests of this kind are found as much as 10° away from the equator There are three enormous areas in the world of this type There is the great area of the basin of the river Amazon in South America, which lies largely in the country of Brazil; then there is the large area which forms the greater part of the basin of the river Congo in Africa, and then there are those islands which lie to the south-east of Asia called the East Indies, as well as part of the mainland of Asia itself Let us take a visit to these regions and see if what is nearly something about the people. If we going, as we say, America, the only way of travelling of the world where there is to follow some of the broader ons near the equator, is one of the largest rivers in the wo're it keeps so equally

a thousand miles up this river from the sea in a great steamer which has brought us across the ocean, then we can penetrate hundreds of miles farther by smaller boats, but in whatever direction we went we should see very few houses and very few towns. for what is man to do in such a region? He cannot very well live in the tree tops as the monkeys do, and if he tries to live on the ground he will find it always damp and unhealthy, so he builds his small settlements often by the river bank where there is some light and air to be had. But the great rivers often overflow their banks, and so it is difficult to find a place which will remain dry. The small numbers of South American Indians who live in the Amazon forests are thus very poor people, and often have to rely for their food on the few fruits which they can gather or roots which they can dig up You may say, why do they not cut down the forest and grow something useful? But think what a tremendous task it would be for these primitive people to cut down the giant trees of the forest and clear a patch of land Even when they have done so weeds would grow up very quickly and would choke any crops they tried to grow. Perhaps, too, the heavy afternoon rains would even wash away the soil itself from their crops and leave nothing but the bare rock underneath. Or, again, the rivers might overflow, as they often do. and wash the crops out of the ground. So this great region of the Amazon Basin remains undeveloped and is likely to remain so for a very long time. You might think the timber from the trees would be very valuable, and so it is Many beautiful hard woods, rather like mahogany in character, can be obtained, but for building our houses we prefer a soft wood which can be sawn easily, and not one which is so extremely hard that it cannot easily be cut into beams and planks for the carpenter's use. Then there are thousands of different kinds of trees in these hot wet forests, and if it is one particular kind we want it is often difficult to go through the forest and pick it out. The crowns of the trees are so far overhead that we cannot see the leaves to

the particular tree we want But there have been some very valuable products that have come out of these forests In the days of old the natives of the Amazon forests used to go in and discovered a tree yielding a valuable juice from which rubber could be made, but they have cut down most of these trees now and there is very little of this wild rubber left. A very similar kind of substance called balata is still obtained in parts of South America. If we go for a moment to the hot wet forests of Africa we find the forests there are not quite so thick and it is possible for some plants to grow on the ground The river Congo is not quite as large as the Amazon and does not overflow its banks so easily, and so in some places it has been possible to make cuttings and to grow crops; but, again, in the denser, wilder parts of the Congo forests it is very difficult indeed for man to live, and it is here that we find a very curious tribe of people called Pygmies Owing to the absence of light and air they are very small people, often not much more than four feet

[Courtesy of the Rubber Growers' Association

FIG 69 —Tapping a rubber tree.

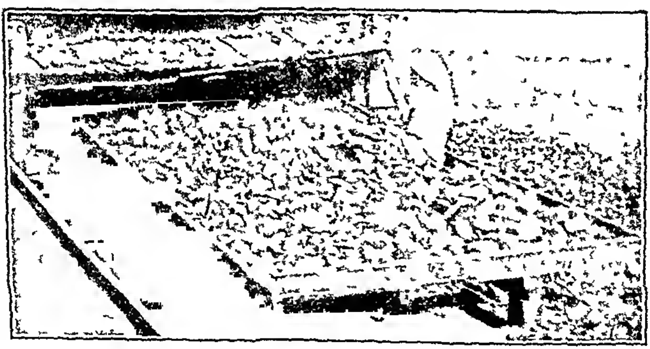
high. They have realised that the monkeys are best off living in the trees where they are nearest to the sunshine, and so the Pygmies have built for themselves huts, often high up in the branches of trees, and they live almost like monkeys. They are very timid people, and travellers through the forest often find it difficult to find them, but they are always very pleased with a present such as a bunch of bananas, for it is difficult for them to get their food. When we come to the hot wet forests of Asia there are still very many wild parts, for example, in the islands of Borneo and Sumatra, but there are other parts where the white man has come along, has cleared away the forests, has overcome the difficulties, and has grown crops for himself. It is said that the equatorial climate is a good servant but a bad master; it is a bad master to those primitive peoples who have not yet learnt to cut down the forest and to grow crops of their own. But to the white man there are many of these equatorial lands which have yielded great profit. When he has cut down, or burnt down, the forest he protects the ground very carefully by growing a low crop which is called a cover crop, so that the soil is not washed away by the rain. The crop binds the soil together very quickly and prevents the growth of weeds It is in these regions of south-east Asia, particularly in the peninsula of Malaya and the island of Java, that we find the great rubber plantations of the world The rubber tree is a native of the South American forests, and when it is cultivated it is not necessary to

[Photo L D Stamp

FIG 70—Cocoapods growing on the tree

cut it down in order to obtain the rubber juice; this is obtained by just tapping the tree as you see being done in the picture. Another plant which thrives in the equatorial regions is the cocoa tree. The cocoa is a small tree growing to a height of 15 or 20 feet, and bears some 20 or 30 pods per year on its stems or main branches Inside these are the cocoa beans, which are taken out and ground to form our cocoa, from which, of course we also make chocolate. Most of the cocoa of the world is now obtained from the fringe of the equatorial belt, from Africa and South America, and Central America In Africa grows the Guinea oil palm, and the oil obtained from the fruits

[Photo E. N. A.
FIG. 71 —The fruit of the oil palm



[Photo L. D. Stamp
FIG. 72 —Coconuts—cracking open the nuts and spreading them out to dry

of this palm form the basis of many of our soaps, or of margarine which is sometimes used instead of butter. On

the margins of the hot wet regions, especially round the coasts of islands, grow the coconut palms, whose nuts, again, yield a valuable oil. Where there are large flat areas that have been cleared in the equatorial regions—for example, as in Java and in Malaya—the great food crop of the people is rice; and because it is hot throughout the year it is possible for the rice crop to ripen at almost any season, and it may be possible to get several crops from one piece of land during the year. For where man has conquered the difficulties of the hot wet forest climate he can grow very many important crops. Another one we have not mentioned is manioc, from South America, from which tapioca can be made.

The Tropical Forests and Tropical Grasslands

The tropical forests and tropical grasslands are found in hot countries, that is, countries between the tropics but outside the equatorial belt. In the equatorial belt the sun is shining directly overhead throughout almost the whole year; but farther north, or farther south, there is one season of the year which we may call the summer when the sun is shining almost overhead, and the other season of the year when it is not nearly so hot We find that in these regions there are really three seasons There is what we call the cool season—we cannot really call it the winter because it never gets cold—it is also usually a dry season. Then, in the Northern Hemisphere, about March or April, the sun begins to shine much more nearly vertically (it is over the Tropic of Cancer exactly on June 21, and over the Tropic of Capricorn in the Southern Hemisphere exactly on December 22), and during this time the land becomes very much heated Much higher temperatures are found in tropical countries at this time of the year than ever occur in the equatorial belt. Because the air is hot it is thirsty and keeps on drinking up more and more moisture as it gets hotter, so there is very little chance of rain falling. But about

May or June this hot air begins to rise and cool air begins to flow in from the ocean to take its place This cooler air brings with it moisture, and as this moisture-laden air begins to rise over the heated land it is cooled, and so we get in the latter part of the hot season or summer the rainy season The rain comes down heavily in the Northern Hemisphere in June, July, August and September, but begins to dry up later in the year. In places near the sea, and near the equatorial belt, the rainfall is often very heavy, and just on the margin of the equatorial belt the dry season is only short, but the farther away from the equator the less the rainfall usually becomes, the longer the dry season. Let us see now what sort of plants and animals we should expect in these regions Where the

FIG 73 —Diagram of the vegetation of the tropics

rainfall is very heavy, or where the dry season is only short, we shall find that it is not very different from the equatorial regions, and so here we find hot wet forests There are some trees however, which cannot really stand even a short dry season, and one of these is the rubber tree, so we do not get very much rubber growing. But as we get away from the equator and the dry season becomes longer, or the rain becomes less, we find that trees will still grow, but they have a hard life during the very hot season and the early part of the year. The water evaporates so quickly from the leaves of the trees that often we see them wilting, as we say, and so most trees protect themselves against this period by losing their leaves. There are, then, deciduous trees, as they are called, which, instead

of resting and losing their leaves during the winter as our trees do in this country when it is very cold, lose their leaves in the hot season as a protection against the great heat. Just at the season of the year when it is hottest it is often very disappointing to go through one of these forests and find there is no shade to be had from the leafless trees. Just before the rains break, the trees burst out into flower and soon afterwards into beautiful green leaf. But in the drier parts of the tropical lands large trees will not grow, only very poor small bushes What do we find instead? We find that the rain comes in the warm season of the year, and this is just right for plants which spring up very rapidly every year and so reach the time when they can flower and fruit Now you all know what happens in the springtime in England—how quickly the grass in our gardens grows, and how the seeds which we have planted earlier in the year begin to sprout so that soon we have borders of beautiful flowers That is exactly what happens over large areas in these tropical lands The chief vegetation is grass, and in the spring of the year, or early part of the summer, when the rain first comes, grass springs up very quickly and often reaches great heights So in some of the tropical grasslands the grass may be six, ten or even fifteen feet high, so high that it is right over the heads of men who walk through it. In the latter part of the year the grass may become dry and brown, a period when it dies away before the fresh green grass comes up again the following year As we get into still drier regions so the grass grows more poorly, and gradually the grasslands fade into desert tracts where there are only just tufts of grass and perhaps a few spiny bushes. Although, therefore, we find forests on the wetter or warmer margins of the tropical lands, the larger part of the whole is covered with grass, and so we often talk about the tropical grasslands. Tropical grasslands cover enormous areas in Africa, particularly in the region called the Sudan, so the type of climate about which we are now talking is often called the Sudan type of climate.

We find it also in South America in the grasslands of the Orinoco and the grasslands south of the great Amazon Basin forests The Tropical Climate is also found in the West Indian islands and in Central America; but there, because the sea is near, there is not the same difference between the hot dry season and the rainy season, and most of these islands get some rain throughout the year, and for that reason favour the growth of trees even more than grass Over large parts of Africa there are scattered

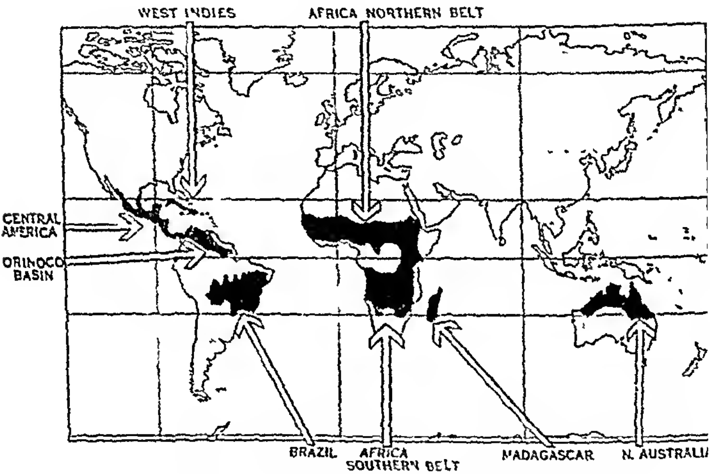


FIG 74.—Map of the world showing where the tropical climate is found

trees amongst the grasslands, and this type of land with scattered trees is often called savana, so the savana lands are really the same as the tropical grasslands We find these savana lands again in the northern tropical belt of Australia.

Now let us think for a minute what sort of animals we should expect to find in these lands. In the forests, of course, there will be monkeys and animals which can live in the trees just as we found in the equatorial regions,

but when we get to the grasslands it [illegible] being a monkey and being able to swing [illegible] bough to bough if there are no trees to climb [illegible] that the animals live mainly on the ground [illegible] two groups of animals. We have spoken [illegible] which the grass grows rapidly and it is [illegible] should find a group of animals which live on this rich grass. These are the grass-eating animals [illegible] You have all heard of the numerous herds of [illegible]

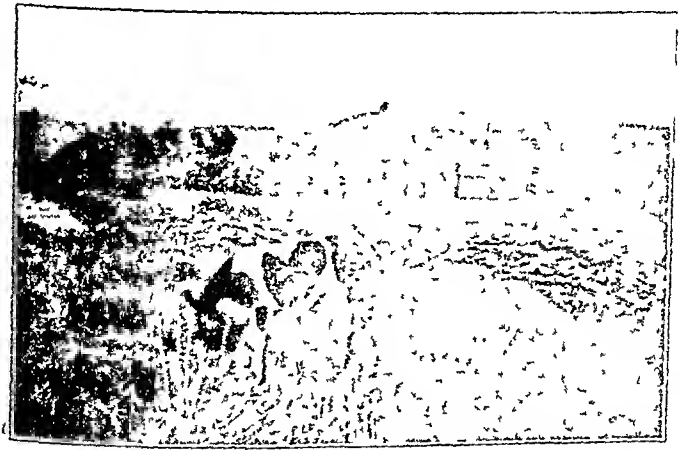


Photo F C Stamp

FIG 75—A small native village in tropical Africa

example, which are still very common in the grasslands of Africa. Then, lurking amongst the long grasses we should expect to find animals such as the lion and the leopard, flesh-eating animals which are just waiting an opportunity to catch the grass-eaters. It is therefore a hard life for the grass-eating animals, and so nature has helped them in two ways. The grass-eating animals usually take a meal of grass very quickly indeed while there is no enemy in sight, and then they go away to some quiet spot where they are safe from their enemies and

not yet really very many people. There is plenty more room for the keeping of herds of cattle and the cultivation of crops. One difficulty in keeping cattle is that there are numerous insects, some of which carry disease from which cattle die. You have probably all heard of the tsetse fly of Africa; and in those belts of Africa where the tsetse fly is abundant it is still impossible for man to keep large numbers of cattle. The chief food crops of tropical lands are corn or maize and, in the drier parts, the grains called millets which we have just mentioned. Sugar-cane is an important crop. In the very wet lands where there are flat lands that can be flooded it is possible to grow rice. One of the most important crops not grown for food is cotton. We shall say something more about cotton presently, but remember that it can be grown in these regions in Africa. No doubt, too you have all tasted monkey-nuts or pea-nuts, a better name for which is ground-nuts. These are not really grown for supplying us with nuts to eat, they are grown because from the nuts is obtained a very valuable oil, and this vegetable oil is used, like so many others, for the manufacture of margarine and soap. The monkey nuts form on the roots of a small plant rather like a pea which will grow in the drier parts of the tropical lands and is fast becoming of very great importance.

The Tropical Monsoon Lands

We have already learnt what a monsoon is and how it is caused, and we mentioned that it is particularly with the greatest land mass of the world, the great continent of Asia, that monsoons are connected. Monsoon winds and the rains which they bring may be found within the tropics of quite hot countries, or they may be found in countries like China and Japan, where it gets very cold in the winter. We are going to talk first about the warmer monsoon lands, and by far the most important of these is India. The same type of climate is also found farther east, in

Burma, in Siam, in Indo-China, and the southern part of China itself. There are really three seasons in the monsoon lands. We cannot again talk about winter, because it never really gets cold enough to call it winter There is the cool season, which is usually dry, when the sun is shining vertically to the south of the equator, and in India the cool season lasts from about November to the end of February or March: then in March, April and May, as the belt of vertical sunshine is passing northwards, the land gradually

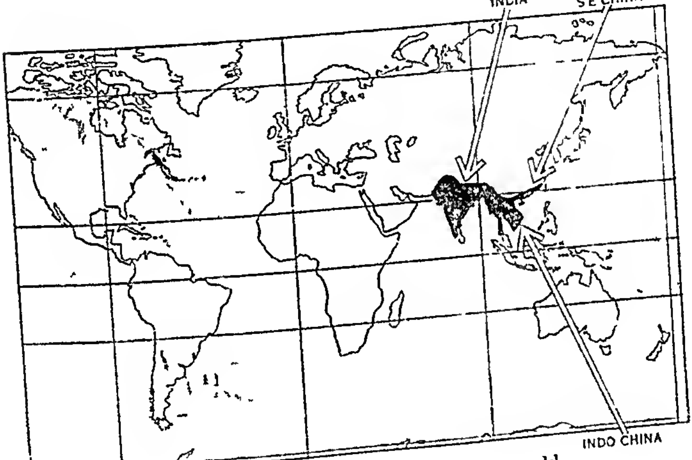


FIG 77—The Monsoon Lands of the world

becomes hotter and hotter and in most parts of India March, April and May are very hot months indeed In this country most of you look forward to your long school holidays which you have in August and the beginning of September so that you may enjoy the English summer, but the boys and girls in India have their holidays much earlier, in March or April or May, because it is so hot at that season of the year that it is really impossible to do any work in school at all. Then the land mass of India, especially northern India, becomes so heated that the hot air rises,

work of ploughing the flooded fields is often carried out by water buffalo, and the little seeds are often planted in a small field called a nursery, and when the plants are a few inches high they are taken out and planted in the larger fields by hand. Thus in India the planting of the rice takes place during the rainy season. As the rains cease the water gradually dries up and towards the harvest-time, which is in December or possibly January, the fields are

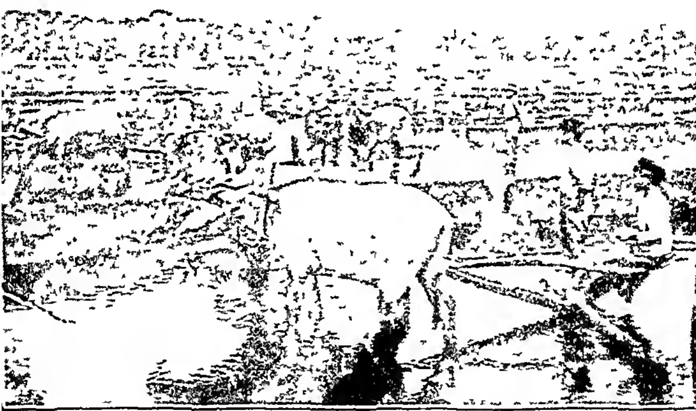


Photo. Exchange News, Agra.

FIG. 78.—Ploughing rice fields with water buffalo.

dry and the rice can be cut in very much the same way as we cut wheat or oats in this country, except that it is usually reaped by hand and not by machine. In India rice covers the greater part of the flat lands of the delta of the great river Ganges, as well as the flat lands along the east and west coasts. As we pass into the drier parts of India so we find that together with the rice fields there are fields of millet and maize, and possibly also of sugar-cane.

(as in Assam). Then there is the island of Ceylon which lies to the south of India Now Ceylon really has a climate which is halfway between that of the monsoon land of India and the hot wet forest of the equatorial belt In Ceylon we get a lot of rubber cultivated as well as some cocoa and coconuts, whilst in the hills tea is a very important crop

Warm Temperate Lands

We now leave the lands which lie within the tropics and turn to those that are just outside. There the summer heat is not quite so great and the winters are often considerably cooler. There are many lands in the world which can be described as warm temperate, but they do not always have the same type of climate. Let us take first of all the temperate monsoon countries of which China and Japan are the two main examples. They have a climate like that of India in that there is a cool season which is dry, a hot season which is dry, and then the rainy season, but their cool season is very much colder. Indeed, in the north of China, it is very cold indeed, much colder than our winters. Much of Japan is covered with snow in the winter time, and in the north of China it is so cold that the rivers are frozen over in the winter. But the summers are very much hotter than our summers and nearly all the rainfall comes in the summer months. In those parts with a warm wet summer it is possible to grow rice, as in central and southern China and the southern part of Japan. Farther north, where the summers are not so hot and wet, we get millets and wheat grown instead. Cotton is also a crop of great

Fig 80 —Cotton—showing method of growth

importance. Perhaps the Chinese is not so fortunate as the Indian in his climate and in his country because there are large stretches of barren mountain, but the Chinese have learnt to make the very most of their land. The Chinese may be called farmers, and yet they are not really farmers; they are exactly what we should call gardeners, that is to say, they cultivate each little tiny piece of land by hand and they grow many different kinds of vegetables, as well as rice and other grain; they also rear animals, notably the pig and chicken. But you will learn more about China and Japan later.

Let us now look at another warm temperate country which is rather different, and that is the south-eastern part of the United States of America. It is the part which is often called the Cotton Belt, for it is here that nearly two-thirds of all the cotton produced in the world is grown. Here the winters are cool, or even cold, but there is a certain amount of rainfall even in the winter: but the main rain comes in the spring and the summer, and less in the autumn. It is in this part of the United States that most of the 10,000,000 negroes, whose great-great-grandparents were many years ago brought over from Africa as slaves to work on plantations, now live. They are, of course, no longer slaves, they work for wages just like white men, but they can work in climates which are really too hot for the white man to work in the fields. We ought first to learn something about the way in which cotton is cultivated before we can understand what happens in the Cotton Belt of the United States. In these warm temperate lands of the south-eastern United States cotton is king. If you look at a physical map of North America you will see that there are no mountains to separate the southern United States from the cold north, and so in winter cold winds sweep down from these northern regions and the winters are often very frosty. So the farmer has to wait in the spring until after the last frost has disappeared before he sows his cotton seed. For the cotton plant is one which is at once killed by a sharp frost. But the spring is

warm and light rains soon help the cotton plant to grow, and a little later the wide fields are ablaze with the bright yellow flowers of the cotton plant The pleasant showers of rain during the summer help the growth, the temperature gets high, higher than in this country, but as the autumn approaches the rain gets less and so when the cotton plant has formed its pods, and these pods burst open to expose the fluffy mass of cotton, there is fortunately no rain that is likely to damage the crop. But as soon, or almost as soon

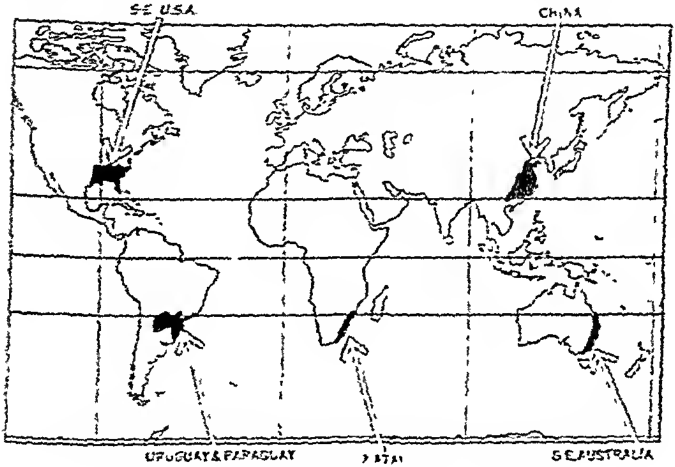


FIG. 81.—*The Warm Temperate regions of the world*

as the cotton "boll" or pod has burst the cotton must be picked. There is really only one important way of doing this, and that is by hand. In the bad days of old, a long while ago, the work of picking the cotton, and of tending the cotton plantations too, was done by the black slaves. It is still the coloured people, though no longer slaves, who do the work. The men, women, and even children, are all kept busy at the cotton harvest. When the cotton has been gathered in it is taken to what is called a ginnery, because the cotton which we

important one, is the maize crop, which is the principal food crop. Many parts of these warm temperate regions are still covered with forest. There are forests of pine trees which yield the valuable timber we call pitch-pine, and there are also forests of broad-leaved trees Florida is rather different from the rest of the south-eastern United States It is too wet, especially at harvest time, to grow cotton, but it has a fine, sunny coast-line, famous for its seaside resorts. No doubt you have seen pictures of Palm Beach, or Miami, on the 'talkies', and probably you have all eaten oranges which have come from Florida

When we turn to the Southern Hemisphere we find that there are three regions which have a warm temperate climate. There is a region in southern Brazil in South America; there is a region on the coast of South Africa, which is roughly that part of the Union of South Africa called Natal; and there is the eastern coastland of Australia, particularly in New South Wales In these three regions the climate is practically the same, but it is quite different from [illegible] in China or the south-eastern United States. Fo[illegible] America, South Africa and Australia are not such bi[illegible]asses, and they do not get so cold in the winter, so [illegible]ters in these southern regions are really quite w[illegible]ist the summers are hot. The rain comes mainly in [illegible]ng and summer, when it is brought by the Trade W[illegible] This mild climate, with a good rainfall and warm [illegible] favours the growth of trees, and so the natural ve[illegible] of these regions is a good forest, and it may even be [illegible]ough for the forests to be evergreen, and we see s[illegible] as tree ferns and palms growing well When th[illegible] cleared crops which like a warm summer, such as [illegible] even sugar-cane—will grow. Where the forest is [illegible] too, there is often a good growth of grass, and s[illegible] part of Australia we get dairy farming carried on. I[illegible] America—that is, in southern Brazil—on the slopes o[illegible], where there is a very good soil, are the great c[illegible] plantations, and this part of Brazil produces nearly th[illegible]ters of all the coffee consumed in the world.

important area is that around the Mediterranean Sea itself—the countries of Spain and Portugal, southern France, most of Italy, the Balkan Peninsula, Palestine, North Africa. Notice that the eastern part of this region—Syria, Palestine and Turkey—is rather near to the great land mass of Eurasia, and so this part of the Mediterranean does get rather cold in the winter, colder than most other regions. Then in North America we have a small but very important tract in the state of California In South America there is central Chile, in South Africa there is the district round Cape Town, in Australia there is the part of Western Australia round Perth, and farther east the region stretching round Adelaide to Melbourne. These are all regions with a Mediterranean climate and they can all grow those products that we have just mentioned That is why we can now buy in our shops raisins and sultanas from South Africa

[Photo L D Stamp

FIG. 83—An Arab school in Aleppo Notice the boys' dress, the flat-topped buildings, and the few small windows (so that the light indoors is not too strong)

or from Australia, as well as from the older European countries, and also from California. We must not forget, too, the oranges and lemons and grape-fruit which grow well with this climate and which we get from these different regions. Next time you buy an orange try and find out from where it has come. If we could go to one of the Mediterranean countries in Europe we should probably see several differences between the houses and those in our own country It gets very hot in the summer in the afternoon, and so in the towns there are often shady piazzas over the pavements so that people can walk along and look at the shops without getting too hot. Then we find that many of the houses have shuttered windows, the shutters let the air through but not the light; and if we went into a small town in Mediterranean Italy or in Mediterranean Spain in summer we should find it very quiet in the afternoon, because most of the people take an afternoon sleep during the heat of the day, or as we call it, a siesta, and then at night-time the whole place wakes up again; and then in the early morning we should find the farmers very busily working out in their fields as soon as it was light and while it was still cool. In many parts of the Mediterranean regions it is quite dry, and so there is not much danger of flooding through heavy rainfall. We find that people even build their houses with flat roofs, or roofs where the water will drain in towards the centre into a rain-water tank, for in certain of the drier parts they may have a difficulty in getting enough water, and so they try and collect some of their own.

The Hot Deserts

In the last two sections we have dealt with lands which lie outside the tropics in the warmer temperate regions We must now return to lands which lie actually along the Tropics of Cancer and Capricorn If you remember what we have learnt about the regular wind systems of the globe we found that both the Trade Winds and the Anti-

trade Winds, or Westerlies, really start from a belt of high pressure just outside the tropics, so that winds in these regions are nearly always blowing outwards. They do not blow from the ocean and bring rain, and so we find a great belt of land along this high pressure belt which is very dry at all seasons, so dry that the result is a great tract of desert The largest deserts are where there are the largest land masses, and so you see that an enormous desert which we call the Sahara stretches right across Africa from

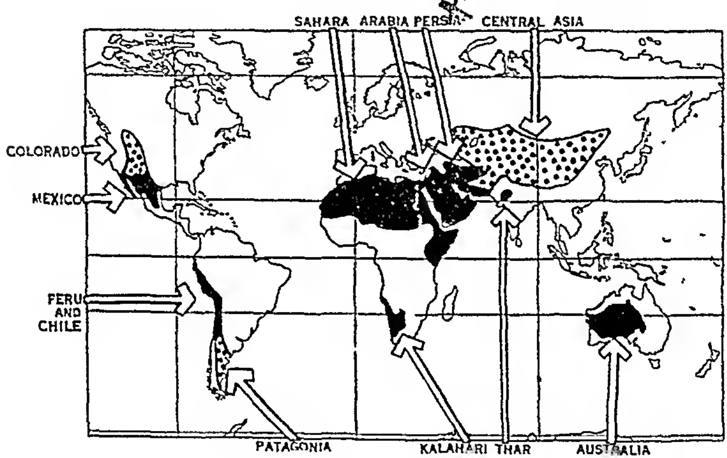


FIG 86 —Map showing the Hot and Temperate Deserts and Semi-Deserts of the world

the Atlantic coast to the extreme east in Egypt. This great desert is continued over most of Arabia and into Persia, and finishes in north-western India. There are large deserts, too, in the same latitudes in North America. In South America the very long narrow desert between the Andes mountains and the sea occupies northern Chile In South Africa there is the desert of the Kalahari, and in Australia there is the great dry heart of the whole continent We cannot really draw a line on a map and say that is really where the desert begins, for on each of its margins

the desert naturally fades into more fertile regions. On the side nearest the equator we have already seen that there are the great tropical grasslands About 20 inches of rainfall a year is the least that is required for cultivation in the tropical grasslands, and so where the rainfall drops below 20 inches in a year the tropical grasslands fade gradually into the deserts On the other margins, away from the equator, in the same way the Mediterranean regions fade into the desert. It really requires about 8 or 10 inches of rainfall a year as the least that is necessary for cultivation to be possible So that where the rainfall drops below this the Mediterranean woodland fades into the desert But over large tracts of the deserts there are a few tufts of grass and bushes, sometimes a few spiny plants which store up water in their own fleshy tissues, and because of this slight vegetation it is possible for animals, and even for man, to exist in the desert. So let us look first of all at the people who live in desert regions. We can say that there are really three groups of people. There are, first, the wanderers, or nomads as we call them. They are able to wander about across the desert because they have as their animal the camel, which, as you know, is often called "the ship of the desert." The camel is able to go for long periods without water and has broad, flat feet which do not sink into the sand, and it is able, too, to carry very considerable burdens You must not think that all the deserts of the world consist of sand. Many of them are rocky deserts, or have a hard surface, so that it is possible for the hardy donkey or mule to be used as a desert transport animal. In modern life, too, there are many deserts that can be crossed by motor cars. There is no need to build roads: the motor cars can be taken straight across the desert, except where there is soft sand. Amongst the nomad inhabitants of the desert are many of the Arabs who live in the Sahara. They act as carriers, and often bring goods from one side of the desert to the other. You have probably all heard of Morocco leather. It is called Morocco leather because we get, or used to get, our

supplies from Morocco, which is a Mediterranean country on the northern side of the Sahara Desert; but, actually, that Morocco leather was made round about Timbuctoo, in Nigeria, and had been brought right across the desert in these desert caravans of camels When times are hard these desert wanderers sometimes turn into bands of robbers Then in the second place, there are the people of the desert who live in the oases An oasis is a fertile spot in the desert—sometimes only a very small tract,

[Photo L. D. Stamp

FIG. 87—A view in a rocky desert

sometimes quite a large area. If there is underground water near the surface trees, such as the date palm, will grow, and it may even be possible to cultivate crops or to keep animals, and on an oasis of the larger kind many people are able to live, such, for example, are found in the great heart of Arabia One of the most important crops, very largely used for food by the desert dwellers is the date which grows on the date palm. Then the third group of people who are desert dwellers are those who go

there because they wish to work the mineral riches. Some of the deserts of the world, as, for example, in Western Australia, contain great gold deposits Then there are desert districts, as on the coast of Egypt and in Persia, where there are great oil fields, and in order to obtain the gold or the oil or the other minerals, towns are built in the midst of the desert, although it may be necessary to carry to those towns every drop of water required and, of course, every particle of food There is one interesting mineral deposit which is found in the desert of northern Chile, and that is a mineral called nitrate It is very largely used for fertilising the soil. Now nitrate is very valuable, and if there were any rain in that region the nitrate would all have been washed away long ago; so this valuable deposit is only left there because the land is really a desert In North Africa, running through the desert there is that famous river, the river Nile This river runs in a valley about 10 miles wide between two high lines of cliffs The river overflows into this narrow valley, and so it enriches the desert soil with silt brought down by itself, and it also moistens the soil, with the result that the Nile Valley in Egypt is very fertile You can really think of it as a very long, big oasis by the side of the river Nile which is made fertile by the waters from the river Thousands upon thousands of people live in this tract and produce large quantities of fine quality cotton, as well as many food crops.

Cool Temperate, or Deciduous Forest, Regions

We must now leave the tropics and the warmer temperate regions and see what happens in the cooler parts of the temperate regions Let us first take lands which lie near the ocean on the western sides of the continents. You remember that on the western sides of the continents nearer the equator we found the Mediterranean lands As we go northwards from these Mediterranean lands we find that we get the regions where the westerly winds are blowing

throughout the year That is to say, there are comparatively warm moist rain-bearing winds blowing from the ocean at all seasons of the year The result is that these lands have rain coming in every month of the year and usually there is not much difference between the amount received in winter and summer, perhaps a little more in the summer. The winters never get very cold—they are, as we say, mild, but the summers, because of the then cooling winds from the ocean, are never very hot The winds

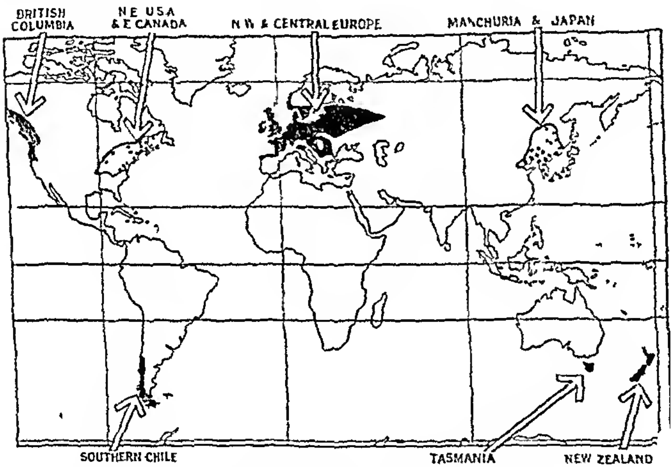


FIG. 88 —Map of the world showing Cool Temperate Deciduous Forest regions (in black)

do not blow constantly, but rather as a succession of cyclones and anti-cyclones, about which we have talked before. We need not say very much more about the climate of these lands because the British Isles give us a very good example. We all know what happens in this country. We have a great many cloudy-days because of the clouds that are brought from the ocean, and we never know from one day to the next when it is going to rain, but we do not often get long periods in the winter with snow and ice,

but only a few days together And in the summer we do not often have long spells of great heat, but only for a short time. Because there is plenty of moisture, trees grow well in this type of climate We find that they usually take their resting period in the cold winter, and so our typical English trees, such as the oak, shed their leaves in the winter time. In the spring they have their fresh new crop, which they keep on during the summer, and then the leaves turn colour and fall again in the autumn Where the trees have been cleared away grass grows very well, and because it is damp throughout the year the grass always remains green, it even grows a little bit in the winter time. These damp pasture lands are very good for cattle, for cattle like the rich green grass, and there is the great advantage that they can be kept out of doors throughout the year. We have, in this country, a great deal of dairy farming, as well as the rearing of cattle for the production of beef. On hill slopes, where the drainage is good but the grass shorter and poorer, there are sheep pastures, whilst in all the richer lands (provided it is not too wet) cultivation is possible. So mild are the winters that it is possible to sow some of the seed—for example, the winter wheat, as we call it—in the autumn It stays in the ground during the winter and then in the spring grows rapidly. In a very cold country it would be damaged, probably even killed, by the hard winter frosts There is not very often the danger of drought or absence of rain, the chief danger is that in the summer there may not be enough sunny weather to ripen the crops, and sometimes the farmer is complaining that his crop of wheat or oats is ruined because it has not been able to ripen—there has not been enough sun The climate of this country is really a very good climate for men We often grumble about our long winter, but it is really a healthy climate It is never too hot in the summer for us to work, and it is not necessary for us to have an afternoon sleep, or a siesta, as people do in Mediterranean countries. Instead of that we can work all through the day. Then in the winter time it really is rather nice to do some hard work

in order to keep warm. So we find that manual labour—work that we do with our hands—can be carried on throughout the year. Let us look for a moment where we find the lands with this type of climate There is the whole of north-western Europe, including the British Isles, and part of France, Belgium, Holland, and part of Germany, as well as Denmark and the coastlands of Norway. As we go eastwards so we are getting towards the interior of the great continent, which as we have learnt several times already gets extremely cold in the winter. So we find as we go eastwards in Europe, into eastern Germany, Poland and Russia, as well as into central Europe and Southern Sweden, winters are much colder than they are in England. This is sometimes called the central European type of climate It is really only a little different from ours, with its colder winters when sometimes the ground is frostbound for weeks together, and with its summers which are usually a little hotter. Then in North America, in the same latitudes, there are the north-western United States and the great province of British Columbia in Canada with this type of climate. Another region is the extreme south of Chile in South America, but this, unfortunately, is not a very good region because it is very mountainous and it gets far too much rain. The high mountains attract a very heavy rainfall of 100 or 200 inches a year, and so with the small amount of flat land and the very great amount of moisture it is really too wet for settlement and cultivation by man. We notice that this type of climate does not occur in South Africa, for the continent of South Africa does not extend sufficiently far south. The same is really true of Australia, but there is to the south of Australia the island of Tasmania which has this type of climate, and so also has the important country of New Zealand. If we look again at Europe we can tell that this climate has been most favourable to man because the great manufacturing countries of Great Britain, France Belgium, Holland and Germany are all situated in tracts having this type of climate. To these we can add those

which have the central European type of climate, such as Czechoslovakia and Poland

The Temperate Grassland Regions

We have just seen that as we go eastwards in Europe from the British Isles, farther and farther away from the ocean, the winters get colder and the summers rather hotter. If we go still farther towards the interior of the

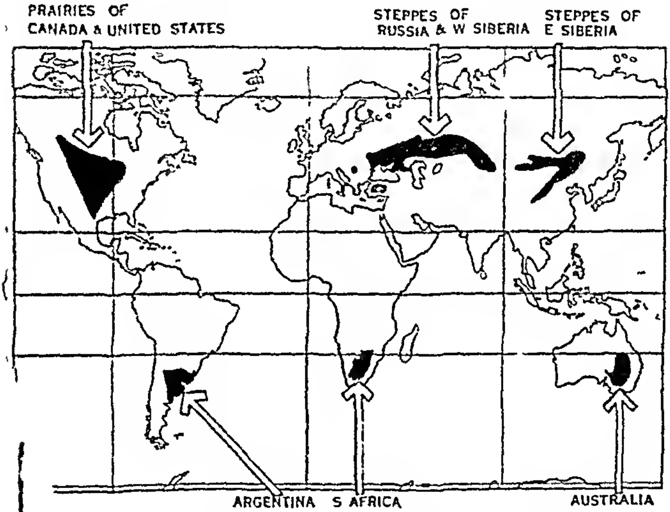
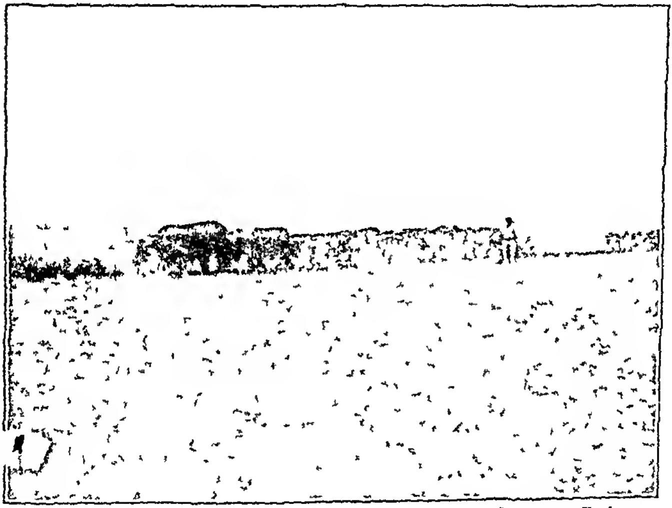


Fig. 89 —Map of the world showing the Temperate Grassland regions

eat land mass we come to regions where the winters are xtremely cold, where the rivers are frozen over for many nonths together and where the ground is frozen hard o a depth of many feet. Here nearly the whole of nature nust take the long winter rest; plants cannot grow, and hey must all wait for the coming of the spring. With the coming of the spring and the warmer days the ground thaws and the snow, which may have fallen during the

winter, melts, and so with the warmth and moisture the ground springs into life and the grass grows up rapidly. Because the interiors of the great continents get very hot in the summer these regions have a very hot summer. Grass grows up very quickly and the seeds are formed, and in the latter part of the summer it may be so hot and dry that the whole surface of the country becomes dry and brown with the withered grass. This is not the sort of climate suited to the growth of trees, for the trees would have to have very long roots to get down to the moisture during the winter, and the long, hard winter would not suit them, and trees cannot grow rapidly enough to take advantage of the spring rains and the melting snows. We find, therefore, that the interiors of the great land masses of the Northern Hemisphere—that is, in Eurasia and North America—are the great temperate grasslands of the world. They are called prairies in North America, but steppes in southern Russia and in southern Siberia. On the steppes there live those animals which feed on the grass, and which, as we saw in the tropical grasslands, are animals which take a hasty meal and then move off to some quiet spot to chew it over again—chew the cud—mostly animals swift of foot so that they can escape quickly from their enemies. It has been found that the wild horse and the wild ass of the steppe lands of Mongolia can travel over 40 miles an hour. Then there are the carnivorous, or flesh-eating animals, which live on these and chase them. In the days of old, man himself was a hunter in these regions. You have all read stories of the Red Indians of North America, what fine horsemen they became, how they hunted the great herds of buffalo and bison which were once abundant on the North American prairies, but which have since almost disappeared. On the steppes of Russia there were the Cossacks who likewise were fine horsemen and hunters. Then came the next stage of the early settlers in the prairies of North America, the early white men, who became cowboys and looked after great herds of cattle. Man had become a pastoralist. Similarly, on the steppes of southern

Russia great herds of cattle and even sheep were kept, but the great temperate grasslands of the Northern Hemisphere—the prairies and the steppes—are fast being converted, and have, in fact, been almost converted into enormous stretches of arable land For where natural grass grows well surely grasses cultivated by man, such as wheat and oats and barley will also flourish. So these grasslands of the Northern Hemisphere have now become



[Photo S African Railways

FIG. 90.—Ploughing on the "High Veld" or grasslands of South Africa

the great granaries of the world. Canada is the largest wheat exporting country in the world, and the production of wheat in the same areas in the United States is likewise enormous. So, too, there are the enormous grain growing areas of southern Russia. But the wheats grown are of a different character from those grown in England, or even in Mediterranean lands. They cannot be sown in the autumn, as they often are in England; they have to be

sown in the spring, and so they are known as spring wheats If we turn to the Southern Hemisphere we find that the continental masses there are very much smaller, and so do not become so cold in the winter time, but there are regions in just the same way which get a light rain in the spring months and rather a hot summer, and although the winters are not so cold, there, too, are grasslands as in the Northern Hemisphere. We have the grasslands called the pampas in the Argentine, in South America, the grasslands

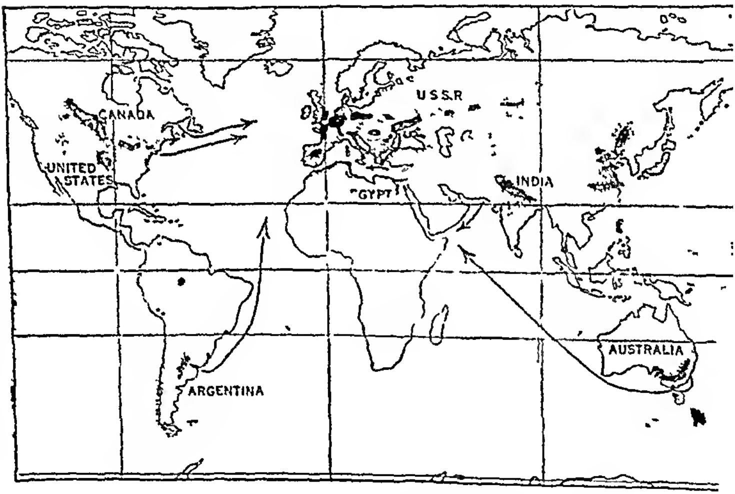


FIG 91 —Map showing the great wheat lands of the world.

on the high plateau in South Africa, and the grasslands in the basin of the rivers Murray and Darling in Australia. Because of the comparatively mild winters animals can be kept out in the open throughout the year, and so we find that these are very important regions for the rearing of sheep and that three of the great wool exporting countries of the world are the Argentine, Australia and South Africa, the wool coming from sheep kept on these temperate grasslands. Then, too, the pampas of South America,

and the downlands, as they are called in Australia, have become very important growers of wheat and other cereal crops. The cereal crop which is grown on these lands in South Africa, where it is rather warmer, is maize But look now carefully at the map showing the distribution of the wheatlands and the wheat exporting countries of the world, and you will see how closely they coincide with these great temperate grasslands Nearly all the grasslands have been developed in comparatively recent years In Canada great cities have sprung up in a few years Winnipeg, the largest of them all in Canada, was founded only about 60 years ago, and it is now a great city of over 200,000 inhabitants

The Temperate Deserts

Most of the things that we said about the Tropical deserts apply also to the Temperate deserts As we get towards the interior of the great continental masses in the Northern Hemisphere, we find that the land becomes drier and drier and the Temperate grasslands fade into Temperate deserts. Where the rainfall is less than 8 or 10 inches it is not possible for grass to grow properly or for man to grow crops The Temperate deserts vary greatly in character. Some of them occupy plateaus at a great elevation above sea-level, such as the great plateau of Tibet, other parts of central Asia are not at such great elevations above sea-level—for example, Mongolia—and they have a climate which is somewhat different Similar Temperate deserts occur on the plateaus amongst the Rocky Mountains of North America, and when we come to the Southern Hemisphere we find the great shingle desert of Patagonia lying to the south of the pampas, or grassland region. But again we find, as in the Tropical deserts, a few people who eke out an existence by wandering about, a number who live in the more fertile valleys that can be irrigated and really correspond to the oases, and there are, of course, people who here and there go to exploit the

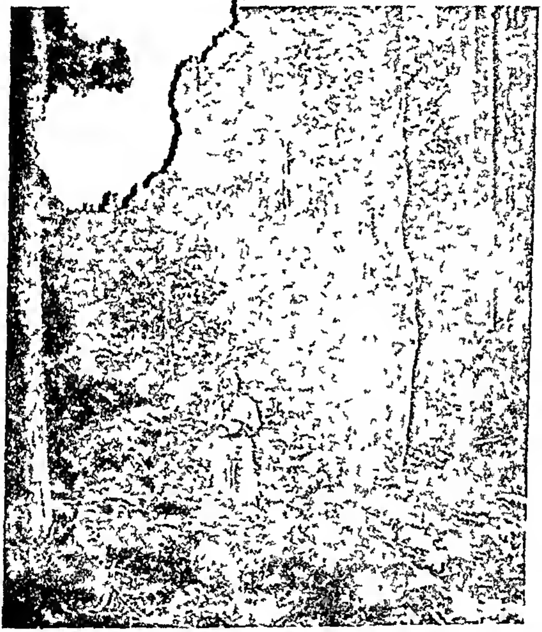
mineral resources that are found in the Temperate desert tracts. (For map, see Fig 86. dotted areas)

The Cool Temperate Regions of the East Coasts

When we were considering the warm temperate regions we found that there was a great difference between the climate of China on the one hand and the climate of the south-eastern United States on the other. Similarly, when we consider the climate of the extreme north of China and of Manchuria, and the neighbouring coastlands, we find that there is a great difference between that tract and the region which occupies a corresponding position in the North American continent, namely, the north-eastern United States and the St Lawrence region of Canada. In Manchuria we find extremely cold winters, because of the winds which blow outwards from the great cold heart of Asia in the winter time. Naturally, also, this country is practically rainless at that time, and so we get conditions which are not very unlike those of the great grasslands. In the summer, when the interior of Asia becomes heated the winds blow in from the ocean and bring with them the monsoon rains, and so we get a region of summer monsoon rains, but with extremely cold winters. The centre of Manchuria is a grassland rather like the prairies of Canada, the hills on either side of the central plain are forested with a mixture of coniferous and deciduous trees. It is a region, still only partly developed, capable of producing over large tracts any of the crops of Canada, and capable of producing from the hills large quantities of timber.

In North America the north-eastern United States and the neighbouring provinces of Canada form an extremely important region. They have a very cold, almost an unpleasantly cold, winter, with the average temperature going below freezing-point for several months of the year The summers get hot, even unpleasantly hot. The characteristic of this region is that the rainfall or snowfall is well distributed throughout the year, that is because the

are in Canada particularly, in the North American continent; in Norway and Sweden, Finland and northern Russia, in Europe and in the great belt across Siberia or northern Asia. We are really using up the reserves of timber and s the world at a very serious rate, and soon th untries that will have any large

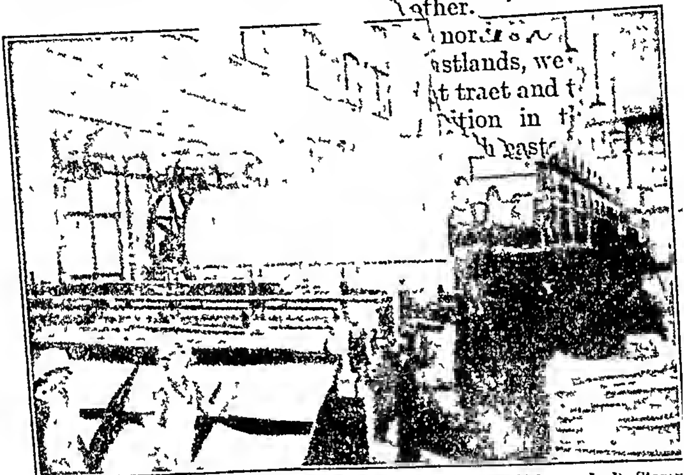


[Photo L D Stamp

FIG. 93.—A typical Coniferous Forest in summer (Finland)

quantities left will be Canada and Russia. We see then that one of the great activities of man in this region is in working the forests. Another activity is in hunting the fur-bearing animals, for in regions that are cold for so much of the year the animals, particularly the wild animals, have teet themselves against the cold by a thick coat.

These coats furnish us with the materials for furs which we largely use for clothing Although a great many of the fur coats worn nowadays are made from rabbit skins, a very large number are from skins of animals found in the northern coniferous forests, and one has only to think of the immense number of people the warm temp every day wearing fur coats to realise that great difference d trapping of animals for the sake of their nd and the el northern other.



[Photo L D Stamp

FIG 94 —Inside a wood pulp and paper mill

regions is a very important industry Although both the timber working and the fur industries are important, there are not really many people living in these regions. That is because it is really too cold for much agriculture to be carried out. The summer is too short or too cool, for example, for wheat to ripen; but in these northern regions the summer days are very long, and, indeed, you know that when we get to the Arctic Circle there is at least one day in the year on which the sun never sets and at least one day in the winter on which the sun never rises. The